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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Attorney Docket No.: 2950.01US02

Kambe et al. Confirmation No.: 6755

Application No.: 09/841,255 Examiner: C. M. Koslow

Filed: April 24, 2001 Group Art Unit: 1755

For: ABRASIVE PARTICLES FOR SURFACE POLISHING

BRIEF FOR APPELANTS

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from an Office Action dated October 28, 2002, in which claims 1-4, 6-10, 12-15 and 23-31 were finally rejected. A Notice of Appeal was filed on November 10, 2003.

REAL PARTY IN INTEREST

NanoGram Corporation, a corporation organized under the laws of the state of Delaware, and having offices at 2911 Zanker Road, San Jose, California, has acquired the entire right, title and interest in and to the invention, the application, and any and all patents to be obtained therefor, as per the Assignment, recorded at Reel 012089, Frame 0565 from the inventors to NeoPhotonics Corporation and an assignment from NeoPhotonics Corporation to NanoGram Corporation, recorded at Reel 013957, Frame 0076. Note that NeoPhotonics Corporation was formerly called NanoGram Corporation, and the present NanoGram Corporation was previously a wholly owned subsidiary of NeoPhotonics Corporation following the formal name change. The present NanoGram Corporation is now an independent corporation, but affiliated with the earlier NanoGram Corporation, now named NeoPhotonics Corporation.

RELATED APPEALS AND INTERFERENCES

Applicants have several other patent applications on appeal. In particular, briefs have been filed in cases 09/136,483 and 09/433,202, which have related subject matter and cited references. However, these cases are do not claim priority back to the present application, and the results of the different appeals do not necessarily interrelate. Nevertheless, the Appeal of 09/136,483 involves issues relating to patents to Rostoker and Declarations relating thereto. Specifically, a Declaration of record in the present application was submitted as evidence in the Appeal of 09/136,483. Following the issuance of a decision by the Board for 09/136,483 and a denial by the Board of a Request For Reconsideration, Applicants have appealed the case to the U.S. Court of Appeal For the Federal Circuit, which is pending.

STATUS OF THE CLAIMS

Claims 1-4, 6-10, 12-15 and 23-31, which are all of the pending claims, stand rejected. The pending claims are listed in Appendix A.

STATUS OF AMENDMENTS

All Amendments have been entered with the filing of the Appeal.

SUMMARY OF INVENTION

The present invention relates to highly uniform collections of a metal compound particles or silicon compound particles and polishing compositions formed from these highly uniform collections of particles. The collections of nanoparticles have an average particle sizes less than about 50 nm or less. The polishing compositions comprise a dispersion of the particles through a medium, which can be an aqueous or non-aqueous liquid. A feature of the particles in some

embodiments is that they have a distribution of primary particle sizes such that less than about 1 in one million (10^6) particle have a diameter greater than about five times the average particle diameter for the collection of particles. In other words, the particles are highly uniform in that the particles do not have a tail in the particle size distribution. In other embodiments, the particle have a narrow distribution of particle sizes relating to the peak of the particle size distribution.

The production of the claimed highly uniform collection of nanoparticles is enabled by the use of laser pyrolysis. Unlike standard chemical reactions under equilibrium conditions, in laser pyrolysis a light beam defines a reaction zone in which the reaction is driven to completion and rapidly quenched to yield the highly uniform particle size distribution. The extreme amount of heat in the reaction zone tends to dissociate reactants within the reaction zone. The species then recombine to form the product compositions. The reaction is rapidly quenched as the particles leave the reaction zone. This quenching terminates further reaction and corresponding particle growth. Since the reaction zone is small and well defined, the product particles are correspondingly uniform. The effectiveness of laser pyrolysis for forming highly uniform particles is described throughout the specification.

Pending independent claim 15 is directed to a highly uniform particle collection comprising non-silicon metal compounds having extremely high uniformity expressed through a cut off in the particle size distribution. Pending independent claim 26 is directed to highly uniform nanoparticles comprising a silicon compound having extremely high uniformity expressed through a cut off in the particle size distribution. In other words, the plot of particle diameters does not have a tail at large diameters. Specifically, less than one particle in one million particles have a diameter more than five times the average diameter. For further description of these uniform particle collections, see the specification, for example, at page 18, line 24 to page 20, line 14. Such particle collections can be used effectively in a variety of applications described in the specification, for example for surface polishing.

Pending claim 1 is directed to nanoparticles comprising a non-silicon metal compound having a narrow distribution of particles sizes near the average particle diameter. This narrowness in the particle size distribution is expressed as a sharp drop in the distribution of particle sizes away from the average particle size. This narrow distribution about the average is independent from the lack of a tail in the distribution, although they both relate to the particle size distribution and uniformity of the powders. Applicants have produced powders with a distribution of particle sizes that is both narrow near its peak and without a tail at larger distributions.

Other aspects of the invention relate to the polishing compositions. Highly uniform particle dispersions can be used advantageously for improve polishing of surfaces. For surfaces that include a plurality of different materials, the particles dispersions can be used to polish the surface to selectively remove one material at a high rate relative to another material. Improved polishing properties of dispersions form with highly uniform aluminum oxide particles formed by laser pyrolysis is described further in published PCT application WO 01/32799.

ISSUES

1. Whether claims 15, 23 and 25 are invalid under the judicial doctrine of obviousness-type double patenting over copending application 09/136,483?

2. Whether claims 1-4, 6, 15, 23-29 and 31 are invalid under the judicial doctrine of obviousness-type double patenting over copending application 09/433,202?

3. Whether claims 26, 29-31 are invalid under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 4,842,837 to Shimizu?

4. Whether claims 1, 2, 6, 7, 9, 15, 23, 25-27 and 29-31 are anticipated under 35 U.S.C. § 102(b) over U.S. Patent 5,389,194 to Rostoker et al. and whether claims 1, 2, 6, 7, 9, 15, 23, 25-27 and 29-31 are anticipated under 35 U.S.C. § 102(e) over U.S. Patent 5,626,715 to Rostoker?

5. Whether claims 27 and 28 are obvious under § 103(a) over the Shimizu patent in view of the Sandhu patent, the Rostoker '194 patent and the Rostoker '715 patent?

6. Whether claims 1, 2, 6-9, 12, 15, 23, 25-27 and 29-31 are obvious under § 103(a) over the Rostoker '194 patent or the Rostoker '715 patent?

7. Whether claims 1-3, 6, 15 and 23-31 are obvious under § 103(a) over the Sandhu patent in view of the Rostoker '194 patent and the Rostoker '715 patent?

GROUPING OF CLAIMS

1. Claims 1-4, 6-10 and 12-14 form a first claim group directed to a polishing composition and corresponding methods of polishing a surface with the polishing composition.

2. Claims 15 and 23-25 form a second claim group directed to a polishing composition with a specified uniformity of particles.

3. Claims 26-29 and 31 form a third claim group directed to a polishing composition comprising a silicon compound and corresponding methods of polishing a surface with the polishing compound.

4. Claim 30 forms a fourth group directed to highly uniform silica with a single crystalline phase with a uniformity of at least about 90 weight percent.

ARGUMENT

I. LEGAL BACKGROUND

The Court of Appeals for the Federal Circuit has exclusive appellate jurisdiction for cases arising under the patent law under 28 U.S.C. § 1295 (a)(1). Federal Circuit patent law is subject to review by the U.S. Supreme Court. The Federal Circuit has adopted as binding precedent all holding of its predecessor courts, the U.S. Court of Claims and the U.S. Court of Customs and Patent Appeals. South Corp. v. U.S., 215 USPQ 657 (Fed. Cir. 1982). Therefore, unless they have

been overruled en banc or by the Supreme Court, CCPA cases are binding precedent for the present appeal.

A. OBVIOUSNESS-TYPE DOUBLE PATENTING IN POST URUGUAY TRADE PERIOD

The judicially created doctrine of obviousness-type double patenting was established to prevent an improper timewise extension of rights to exclude under the patent laws. See, for example, MPEP 804 IIB and references therein. All patents issuing from applications filed after June 8, 1995 (six months after the Uruguay trade agreements were implemented in the Uruguay Round Agreements Act, referred to herein as the post-URAA period) have a patent term of twenty years from their earliest priority date subject to any patent term extension. The changes in patent term affect the application of obviousness-type double patenting since the foundation of obviousness-type double patenting relates to patent term. However, the issues raised herein evidently are ones of first impression in that the U.S. Supreme Court, the U.S. Court of Appeal for the Federal Circuit and the PTO Board of Patent Appeals and Interferences do not seem to have ruled on the subject. In other words, the law and procedures have not been changed to reflect the fundamental changes in patent term. In particular, Applicants assert that a pending patent application with a priority date after June 8, 1995 should not be rejected for obviousness-type double patenting over a later filed application/patent, but if the earlier filed application can be rejected for obviousness-type double patenting over a later filed application/patent, a two way test for obviousness should be applied.

Under the pre-URAA rules, a two way test for obviousness was applied to determine whether or not to reject a pending patent application for obviousness-type double patenting over a patent that was later filed if the applicant could not have filed the claims in a single application and there was administrative delay. Eli Lilly & Co. v. Barr Labs., 251 F.3d 955, 975 (Fed. Cir.

2001); In re Berg, 140 F.3d 1428, 1434 and 1435 (Fed. Cir. 1998). A two way test was similarly mandated in the case of a double patenting rejection over a later filed application not yet issued as a patent, for patent applications in circumstances in which there were administrative delays of the PTO in prosecuting the first filed application and the applicants could not have filed the conflicting claims in an earlier filed application. However, in the pre-URAA period a later filed application that issued before a first filed application expired first since term was based on issue date rather than filing date. This is no longer true unless the first filed application has a patent term extension. Thus, the circumstances are inherently different.

Under the two-way test, the examiner not only asks whether the particular application claims are obvious over the patent claims (or the claims of the later filed application), but the examiner also asks whether the patent claims are obvious over the application claims. In re Berg at 1432. If not, the application claims later may be allowed. Id. The one-way test applies if the application at issue is the later filed application, both applications are filed on the same day, or the applicant could have filed all of its claims in the first application but elected not to. MPEP 804 II.B.1.(a); In re Berg, at 1434. An applicant could have filed all of its claims in one application when the disclosure of the earlier filed application will support the claims in the later filed application. Id. This is consistent with the policy of granting an applicant a patent in exchange for disclosure to the public of all of the information relating to the invention; and thus, preventing an unjustified extension of the patent term by not disclosing all of the developments in one application. However, the two-way test was designed to prevent invalidity for obviousness-type double patenting where the applicants filed first for a basic invention but later for an improvement thereof. Id. at 1432. This is consistent with exchanging a patent for public disclosure of additional developments that were not known at the time of the initial basic invention.

Under the pre-URAA procedure, if the later filed application had not issued, the double patenting rejection is provisional. If the provisional double patenting rejection becomes the only remaining rejection, the double patenting rejection is withdrawn and the case allowed to issue. See MPEP 804 I.B. Of course post-URAA, if the application under consideration is the second filed application, it does not make sense to withdraw the obviousness-type double patenting rejection just because the first filed application has not issued since the second filed application will expire later regardless of when it issues unless there is patent term extension. But if the application under consideration is the first filed application, the provisional rejection does not make any sense in the first instance.

Below Applicants present an analysis of the post-URAA circumstance in view of statutory changes based on analogy with the relevant pre-URAA law summarized above and the new statutory scheme. Applicants conclude that the USPTO and the courts lack the authority to impose a non-statutory double patenting rejection of a previously filed application over a later filed application (or a corresponding issued patent) since such a rejection is contrary to the provisions of the patent term extension legislation. Even if the USPTO has the authority, a two-way obviousness test should be imposed unless the patentee could have presented the claims of the later filed application in the first filed application to be consistent with the judicial framework put into place for pre-URAA patent applications.

In the pre-URAA period, a later filed application that issued before a first filed application expired first. However, this is no longer true because the term of the patent is 20 years from the date of filing unless the first filed application has a patent term extension. 35 U.S.C. § 154. Thus, the post-URAA circumstances relating to term are inherently different. Under the current rules, the length of time an application remains in prosecution simply diminishes the effective length of the patent term accordingly. Id. at 1435, n9. Thus, the prosecution of a first filed application can never be an attempt to extend the term of a later filed

application. So in a post-URAA period, the policies underlying an obviousness-type double patenting rejection no longer apply to a patent application based on the later filing of another patent application.

In response to Applicants' argument in the Preliminary Amendment of September 6, 2002 that a first filed application could not be an attempt to extend the term of a later filed application, the Examiner asserted that two reasons compel the continued rejection for obviousness-type double patenting. Specifically, the Examiner indicated that the terminal disclaimer was compelled by the possibility of patent term extension under 35 U.S.C. 154(b) and the requirement of common ownership imposed by a Terminal Disclaimer under 37 C.F.R. 1.321(c). Applicants maintain that neither of these reasons are reasonable, and neither compels the filing of a Terminal Disclaimer in the present case.

Patent term extensions were designed by Congress to address delays in prosecution of a patent application in the Patent Office. Application of the double patenting rules, as suggested by the Examiner, would be contrary to the express language of the statue and the purpose of the patent term extension. The judicial doctrine of obviousness-type double patenting was long established when the present form of patent term adjustment was enacted by Congress. Since 35 U.S.C. 154 does not limit patent term adjustment, we can assume that Congress intended to overturn obviousness-type double patenting directed explicitly to limiting patent term adjustment. Neither the Patent Office nor the courts have the authority to circumvent statutory mandates. The statute could have been drafted by Congress to impose the double patenting limitation on the patent term adjustment, but was not. Therefore, even the use of a obvousness-type double patenting rejection is not allowed by statute to eliminate a statutory patent term adjustment.

With respect to the requirement of common assignment under a terminal disclaimer, this presumes a proper double patenting rejection. See In re Van Ornum, 214 USPQ 761, 763-767

(CCPA 1982). Applicants maintain that the obviousness-type double patenting rejection is not proper and should be withdrawn and that the requirement of common assignment is not fair under the present circumstances. A patent should not have to be terminally disclaimed over a later filed improvement patent to impose a requirement that they remain commonly owned. This is especially clear without the imposition of a two-way test for establishing obviousness-type double patenting.

B. ANTICIPATION

1. Examiner's Burden

The Examiner has the burden of establishing a prima facie case of anticipation. As such, the Examiner must provide a reference that discloses every element as set forth in the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F2d. 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) (MPEP §2131).

2. A Single Reference Must Identically Disclose Every Element Set Forth In a Claim To Anticipate The Claim

"In order to constitute anticipatory prior art, a reference must identically disclose the claimed compound..." MPEP 2122 citing In re Schoenwald, 22 USPQ2d 1671, (Fed. Cir. 1992). "For a prior art reference to anticipate in terms of 35 U.S.C. § 102, **every element of the claimed invention must be identically shown in a single reference**. These elements must be arranged as in the claim under review, but this is not an 'ipsissimis verbis' test." In re Bond, 15 USPQ2d 1566, 1567 (Fed. Cir, 1990)(Internal citations omitted and emphasis added.).

"If the prior art reference does not expressly set forth a particular element of the claim, that reference still may anticipate if that element is 'inherent' in its disclosure. To establish

inherency, the intrinsic evidence 'must make it clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'" In re Robertson, 49 USPQ2d 1949, 1950, 1951 (Fed. Cir. 1999), citing Continental Can Co. v. Monsanto Co., 20 USPQ2d 1746, 1749 (Fed. Cir. 1991).

"Every element of the claimed invention must be literally present, arranged as in the claim. **The identical invention must be shown in as complete detail as is contained in the patent claim.**" Richardson v. U.S. Suzuki Motor Corp., 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)(Internal citations omitted, and emphasis added.); see also MPEP 2131. "Here, as well, anticipation is **not** shown by a prior art disclosure which is only '**substantially the same**' as the claimed invention." Jamesbury Corp. v. Litton Industrial Products, Inc., 225 USPQ 253, 256 (Fed. Cir. 1985)(emphasis added).

Similar requirements also hold under an obviousness rejection. Prima facie obviousness is not established if all the elements of the rejected claim are not disclosed or suggested in the cited art. In re Ochiai, 37 USPQ 1127, 1131 (Fed. Cir. 1995). ("The test for obviousness *vel non* is statutory. It requires that one compare the claim's 'subject matter as a whole' with the prior art 'to which said subject matter pertains.'"). See also, MPEP 2143.03 "All Claim Limitations Must Be Taught or Suggested," citing In re Royka, 180 USPQ 580 (CCPA 1974). "To establish prima facie obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art." MPEP 2143.03.

3. Ranges

Claims covering a range of composition narrower than a broader range covered in the prior art are not anticipated, although they may be obvious over the prior art. In re Malagari, 182 USPQ

549, 553 (CCPA 1974). Such claims are analogous to the claim of a species or subgenus within a genus, which may be patentable and generally are not obvious. See MPEP 2131.02 and 2131.03.

4. To Support A Finding Of Unpatentability Based On Cited Art, The Cited Art Must Provide A Means Of Obtaining The Claimed Composition Or Apparatus

The proposition is well established that the cited art only renders a composition of matter or apparatus unpatentable to the extent that the cited art enables the disputed claims, in other words, if the cited art provides a means of obtaining the claimed composition or apparatus.

> To the extent that anyone may draw an inference from the Von Bramer case that the mere printed conception or the mere printed contemplation which constitutes the designation of a 'compound' is sufficient to show that such a compound is old, regardless of whether the compound is involved in a 35 U.S.C. 102 or 35 U.S.C. 103 rejection, we totally disagree. ... We think, rather, that the true test of any prior art relied upon to show or suggest that a chemical compound is old, is whether the prior art is such as to place the disclosed 'compound' in the possession of the public. In re Brown, 141 USPQ 245, 248-49 (CCPA 1964)(emphasis in original)(citations omitted).

Similarly, see In re Hoeksema, 158 USPQ 596, 600 (CCPA 1968)(emphasis in original):

> We are certain, however, that the invention as a whole is the claimed compound and a way to produce it, wherefore appellant's argument has substance. There has been no showing by the Patent Office in this record that the claimed compound can exist because there is no showing of a known or obvious way to manufacture it; hence, it seems to us that the 'invention as a whole,' which section 103 demands that we consider, is not obvious from the prior art of record.
>
> While there are valid reasons based on public policy as to why this defect in the prior art precludes a finding of obviousness under section 103, In re Brown, supra, its immediate significance in the present inquiry is that it poses yet another difference between the claimed invention and the prior art which must be considered in the context of section 103. So considered, we think the differences between appellant's invention as a whole and the prior art are such that the claimed invention would not be obvious within the contemplation of 35 U.S.C. 103.

The Federal Circuit has further emphasized these issues. Assertions in a prior art reference do not support an anticipation or obviousness rejection unless the references place the claimed invention in the hands of the public. Beckman Instruments Inc. v. LKB Produkter AB, 13 USPQ2d 1301, 1304 (Fed. Cir. 1989). "In order to render a claimed apparatus or method obvious, the prior art must enable one skilled in the art to make and use the apparatus or method." Id. While a properly citable reference is prior art for all that it teaches, references along with the knowledge of a person of ordinary skill in the art must be enabling to place the invention in the hands of the public. In re Paulsen, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994). See also In re Donohue, 226 USPQ 619, 621 (Fed. Cir. 1985). "[A] § 102(b) reference "must sufficiently describe the claimed invention to have placed the public in possession of it." Paperless Accounting, Inc. v. Bay Area Rapid Transit Sys., 804 F.2d 659, 665 (Fed. Cir. 1986), cert. denied, 480 U.S. 933 (1987)(quoting In re Donohue, 766 F.2d at 533). An enabling disclosure is one that allows a person of ordinary skill to practice the technology without undue experimentation based on the guidance in the disclosure along with what is well known in the art. In re Wands, 858 F. 2d 731, 737 (Fed. Cir. 1988).

See also, Ex parte Logan, 38 USPQ2d 1852, 1856 (BPAI 1994) (unpublished). While this Board case is not binding precedent or even published, it is probative of an appropriate analysis under the present facts. In Ex parte Logan, Id., the claims were rejected over a patent and a corresponding patent application. In response to the rejection, appellants argued that the cited patent and application were inoperable. In support of the appellants' assertions, a declaration was presented. The Examiner dismissed the declaration as mere opinion by an interested party. The Board in this case noted that the factual evidence presented in the declaration was probative of the issues. Furthermore, the Examiner did not offer any evidence or argument that the required modifications to make the previous invention functional would have been made by a person of ordinary skill in the art. The board concluded that the appellant had met their burden of rebutting the presumption of operability of the prior art patent by a

preponderance of the evidence. Id. In reaching this holding, the court expressly noted that, "the examiner has failed to shoulder his burden of rebutting the appellant's evidence of non-enablement/inoperability." Id.

The point is further taken in In re Payne, 606 F.2d 303, 315 (C.C.P.A. 1979) (citing In re Hoeksema, 399 F.2d 269, 275 (CCPA 1968)), where the Court stated, "To successfully rebut the examiner's *prima facie* case of enablement, it was incumbent upon Payne [appellant] to introduce affidavits or other factual evidence in support of his position. ...facts set forth in an affidavit (37 CFR 1.132) of an expert in the field suggesting that inoperativeness, would be highly probative." Id. (citations omitted).

C. OBVIOUSNESS

1. The Examiner bears the burden of demonstrating nonobviousness.

The Applicants note that the patent office has the burden of persuasion in showing that the Applicants are not entitled to a patent. "[T]he conclusion of obviousness vel non is based on the preponderance of evidence and argument in the record." In re Oetiker, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992). The patent office has the ultimate burden of persuasion in establishing that an applicant is not entitled to a patent. Id. at 1447, concurring opinion of Judge Plager. **"The only determinative issue is whether the record as a whole supports the legal conclusion that the invention would have been obvious."** Id.

"In rejecting claims under 35 U.S.C. §103, the examiner bears the initial burden of presenting a prima facie case of obviousness." In re Rijckaert, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). Prima facie obviousness is not established if all the elements of the rejected claim are not disclosed or suggested in the cited art. In re Ochiai, 37 USPQ 1127, 1131 (Fed. Cir. 1995). ("The test for obviousness *vel non* is statutory. It requires that one compare the claim's 'subject matter as a whole' with the prior art 'to which said subject matter pertains.'"). See also, MPEP 2143.03 "All

Claim Limitations Must Be Taught or Suggested," citing In re Royka, 180 USPQ 580 (CCPA 1974). "It is impermissible, however, to simply engage in a hindsight reconstruction of the claimed invention, using applicant's structure as a template and selecting elements from references to fill the gaps." In re Gorman, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991).

If the Examiner fails to establish a prima facie case of obviousness, the obviousness rejection must be withdrawn as a matter of law. In re Ochiai, 37 USPQ at 1131 ("When the references cited by the examiner fail to establish a prima facie case of obviousness, the rejection is improper and will be overturned.").

2. There Must Be Motivation In The Art To Modify The Teachings Of the Cited References

The motivation, or suggestion, to combine references must be either explicitly or implicitly in the references or knowledge "generally available to one of ordinary skill in the art." See, MPEP § 2143.01. Furthermore, "[t]he test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." See, MPEP §2143.01 (quoting In re Kotzab, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000)).

The Federal Circuit has provided considerable guidance on establishing obviousness of a claim based on a combination of references. "Our case law makes clear that the best defense against hindsight-based obviousness analysis is the rigorous application of the requirement of a teaching or motivation to combine the prior art references." *Ecolochem Inc. v. Southern Edison*, 56 USPQ2d 1065, 1073 (Fed. Cir. 2000). "Therefore, '[w]hen determining the patentability of a claimed invention which combines two known elements, 'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.' " *Id.* (quoting *In re Beattie*, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992)(quoting *Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co.*, 221

USPQ 481, 488 (Fed. Cir. 1984))). "In order to prevent a hindsight-based obviousness analysis, we have clearly established that the relevant inquiry for determining the scope and content of the prior art is whether there is a reason, suggestion, or motivation in the prior art or elsewhere that would have led one of ordinary skill in the art to combine the references." *Ruiz v. A.B. Chance Co.*, 57 USPQ2d 1161, 1167 (Fed. Cir. 2000). **"The test is not whether one device can be an appropriate substitute for another."** *Id.* (emphasis added). In *Ruiz*, the Federal Circuit overturned a district court holding that "it would have been obvious to combine screw anchors and metal brackets, because the need for a bracket 'was apparent.'" *Id.*

When the modification of an apparatus renders the apparatus "inoperative for its intended purpose," the reference teaches away from the suggested modification. In re Gordon, 221 USPQ 1125, 1127 (Fed. Cir. 1984). "If when combined, the references 'would produce a seemingly inoperative device,' then they teach away from their combination." Tec Air Inc. v. Denso Manufacturing Michigan Inc., 52 USPQ2d 1294, 1298 (Fed. Cir. 1999)(citing In re Sponnoble, 160 USPQ 237, 244 (CCPA 1969)).

3. The References Must Provide A Reasonable Expectation Of Success

While a reference is prior art for all that it teaches, references along with the knowledge of a person of ordinary skill in the art must be enabling to place the invention in the hands of the public. In re Paulsen, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994). See also In re Donohue, 226 USPQ 619, 621 (Fed. Cir. 1985). "The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood success, viewed in light of the prior art." Micro Chemical Inc. v. Great Plains Chemical Co., 41 USPQ2d 1238, 1245 (Fed. Cir. 1997)(quoting In Re Dow Chemical Co., 5 USPQ2d 1529, 1531 (Fed. Cir. 1988)).

4. The References Must Teach Or Suggest All Of The Claim Elements

"To establish prima facie obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art." MPEP 2143.03.

5. Compositions Of Matter

It is long established that a composition of matter is indistinguishable from its properties. In re Papesch, 137 USPQ 43, 51 (CCPA 1963); In re Cescon, 177 USPQ 264, 266 (CCPA 1973). There are two types of properties, chemical/compositional properties and physical properties. The chemical/compositional properties of the composition of matter determine what the material is, while the physical properties relate to the interaction and behavior of the composition of matter. Often unique or unexpected physical properties are used to establish the existence of an unobvious composition when chemical/compositional properties either are unknown or do not fully represent the unobviousness of the composition. However, discovery of a surprising or unexpected physical property does not necessarily control an obviousness determination, and all the evidence under the Graham factors must be considered. See, for example, Richardson-Vicks v. Upjohn Co., 44 USPQ2d 1181, 1187 (Fed. Cir. 1997). **In the present case, the claims do not relate to the discovery of properties of previously known or suggested materials.**

6. Obviousness Over A Single Prior Art Reference

The importance of the principle that the prior art itself must suggest the motivation to modify the teachings of a reference was eloquently stated in In re Rouffet, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998)(emphasis added):

> The Board did not, however, explain what specific understanding or technical principle within the knowledge of one of ordinary skill in the art would have suggested the combination. **Instead the board merely invoked the high level of skill in the field of the art. If such a rote invocation could suffice to supply a motivation to combine, the more sophisticated scientific fields would rarely, if ever, experience a patentable technical advance.** Instead, in complex scientific fields, the Board could routinely identify the prior art elements in an application,

> invoke the lofty level of skill, and rest its case for rejection. **To counter this potential weakness in the obviousness construct, the suggestion to combine requirement stands as a critical safeguard against hindsight analysis and rote application of the legal test for obviousness.**

Similar principles must be applied when obviousness is based on the teachings of a single cited reference.

> In appropriate circumstances, a single prior art reference can render a claim obvious. However, there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion. This suggestion or motivation may be derived from the prior art reference itself, from the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. **Determining whether there is a suggestion or motivation to modify a prior art reference is one aspect of determining the scope and content of the prior art, a fact question subsidiary to the ultimate conclusion of obviousness.**

Sibia Neurosciences, Inc. v. Cadus Pharmaceutical Corp., 55 USPQ2d 1927, 1931 (Fed. Circuit 2000)(internal citations omitted, emphasis added).

II. ANALYSIS

A. OBVIOUSNESS-TYPE DOUBLE PATENTING REJECTIONS

The two pending obviousness-type double patenting rejections are considered together since the legal error relating to these rejections are common to both rejections. In summary, the rejections of the pending claims were made under the judicial doctrine of obviousness-type double patenting of claims 15, 23 and 25 over copending application 09/136,483 and claims 1-4, 6, 15 and 23-25 over copending application 09/433,202. With all due respect, the Examiner misapplied a judicial doctrine applicable under pre-URAA law in situations following URAA modifications of patent term. The MPEP has not been appropriately modified in view of the changes in patent term.

The filing of a non-obvious improvement patent application does not convert the first filled patent application into a way to extend the term of the later filed improvement patent. A

patent applicant should not be punished for the patenting of improvements by the requirement of filing a terminal disclaimer that imposes a common ownership requirement. In addition, where does this requirement end? It is certainly now not the practice of filing terminal disclaimers for issued patents for every later filed improvement patent. But under current Patent Office practice, this should be done since there is no clear basis for when such a terminal disclaimer would or would not be appropriate. The implication is that the first filed claims are obvious over an improvement patent. Typically, the claims of the pioneering patent are obvious over the claims of the improvement patent. Thus, a patent would need to be terminally disclaimed over improvement patents that issue 10, 15 up to 20 years after its filing date.

The patent Examiner agued that a continuing rational is that the first filed application can get patent term extension. But the Examiner did not argue that patent term extension was a prerequisite for the imposition for the obviousness-type double patenting rejection. If a patent term extension of the application is a pre-requisite, this issue raised by the Examiner is not ripe since the present application has not issued. Thus, there is no patent term extension that would raise the obviousness-type double patenting issue. However, Applicants maintain that even if there is a patent term extension, there is no obviousness-type double patenting under the statutory scheme. Also, Congress instituted patent terms extension for carefully considered reasons. These should not be eliminated by the Patent Office without Congressional approval

Furthermore, the second filed applications have not issued as patents. The obviousness-type double patenting rejections are provisional. The provisional double patenting rejection should not prevent issuance of the patent, see MPEP 804 (I)(B). By analogy with the pre-URAA analysis, the Examiner has not asserted a proper provisional rejection since it must involve a two-way test under MPEP guidelines. Also, **requiring less than a two-way test would yield an unfair result.** If a later invention is filed on a non-obvious improvement, a patentee should not be required to file a terminal disclaimer for the broader parent invention based on the filing of

the non-obvious improvement patent. This requirement would discourage the invention and patenting of non-obvious improvements. Such a result is not reasonable nor was this the intention of Congress by the imposition of patent term extension.

In the pre-URAA situation, patent term was based on the issue date of a patent such that delays in prosecution were addressed by the reference point of the patent term. Under the present statute, if the first filed patent is delayed and obtains a term extended beyond the expiration of the later filed patent, this is analogous to the pre-URAA situation of MPEP II(B)(1)(b), in which the "issued patent" (i.e., the earlier expiring patent) is the later filed application. For these situations, a two-way obviousness test was required and still is required with respect to pre-URAA applications. If the claims of the later filed application are not obvious over the claims of the earlier filed patent application, the term of the second filed application is not being improperly extended by the patent term extension of the first filed application, and the double patenting rejection is improper.

The Examiner argued on page 5 of the Office Action of October 28, 2002 that "First, 35 U.S.C. 154(b) includes provisions for patent term extension based upon prosecution delays during the application process. Thus, 35 U.S.C. 154 does not ensure that any patent issuing on a utility or plant application filed on or after June 8, 1995 will necessarily expire 20 years from the earliest filing date for which a benefit is claimed under 35 U.S.C. 120, 121 or 365(c). Second, 37 CFR 1.321(c)(3) requires that a terminal disclaimer filed to obviate a judicially created patenting rejection including a provision that any patent is commonly owned with an application or patent which formed the basis for the rejection." Clearly, the Examiner's second reason is circular since the justification for a double patenting rejection cannot be that if there is a valid double patenting rejection the terminal disclaimer should require common assignment. This is an argument for structuring the terminal disclaimer and not for making a double patenting rejection in the first instance.

In the post-URAA, the only possible justification for an obviousness-type double patenting rejection of an application with an earlier priority date over an application with a later priority date is the term extension of the earlier application. However, the double patenting rejection negates the patent term extension contrary to the statute. Congress enacted the post-URAA patent term extension to account for patent term in the event of delays in prosecution in the patent office. The statute at 35 U.S.C. 154(b) provides for patent term extension. Congress did not provide in the statute for the diminution of the extension due to the filing of a later application, which is the direct and only effect of imposing an obviousness-type double patenting rejection on a patent application with an earlier priority dated over an application with a later priority date. Since Congress did not provide for attenuation of the mandated patent term extension under the long established principle of obviousness-type double patenting, the courts and the Patent Office do not have the authority to undermine the Congressionally granted patent term extension. Imposition of an obviousness-type double patenting rejection just to reduce the statutory patent term extension should be an issue for Congress. Furthermore, a patent term extension based on Food and Drug Administration approval under 35 U.S.C. 155 has never been suggested to be a basis for an obviousness-type double patenting rejection.

Under post-URAA patent term rules, an application with a later priority date expires later than a patent application with an earlier priority date unless there is an appropriately long patent term extension of the earlier patent application. Thus, without a patent term extension, the situation is analogous to the pre-URAA situation in which the later filed application issued first such that it had a later expiration date, **which did not result in an obviousness-type double patenting rejection of the first application over the later application**. See MPEP 804. An obviousness-type double patenting rejection of an earlier priority application over a later priority application is only reasonable (if ever) if the earlier application has an **actual** patent term extension such that it expires later than the later application.

Assuming Arguendo the courts and the Patent Office do have the statutory authority to impose an obviousness-type double patenting rejection of an application with an earlier priority date over an application, it can only be imposed after a determination is made that a patent term extension will extend the term of the application beyond the term of the application with the later priority date. Then, the obviousness-type double patenting rejection must be applied with due notice to the judicial framework imposed under pre-URAA law for an earlier filed application rejected for double patenting over a later filed patent/application. In particular, the existence of a patent term extension under 35 U.S.C. 154 indicates that a delay has already been caused by the Patent Office, as officially recognized by statute. Thus, unless the applicant could have filed the claims in the application with the earlier filing date, a two-way obviousness test must be used to determine whether or not an obviousness-type double patenting rejection is proper. The Examiner did not determine that a term extension would extend the term of the present application beyond the term of the later filed applications, and the Examiner did not use a two-way obviousness test. Thus, even assuming Arguendo that the Patent Office has authority to undermine the patent term extension provisions imposed by Congress, the rejection was not properly based on the presence of an appropriate patent term extension and on a two-way obviousness evaluation. Therefore, the rejection is improper and should be withdrawn.

In summary, the only possible rational to impose a double patenting rejection based on a later filed patent/application is the extension of the term of the first filed patent. However, the courts and the Patent Office do not have statutory authority to contravene the extension of patent term through requiring a Terminal Disclaimer. If the authority is present Arguendo, a two-way test should be used unless the later filed claims could have been filed in the earlier application. Even then, it is only proper if there is an actual patent term extension. In view of this, Applicants respectfully request withdrawal of the rejection based on obviousness-type double patenting of

claims 15, 23 and 25 over copending application 09/136,483 and claims 1-4, 6, 15 and 23-25 over copending application 09/433,202

B. REJECTIONS UNDER 35 U.S.C. § 102(b) OVER SHIMIZU

The Examiner rejected claims 26 and 29-31 as anticipated under 35 U.S.C. § 102(b) over U.S. Patent 4,842,837 to Shimizu et al. (Appendix B, the Shimizu patent). The Examiner notes that the Shimizu patent teaches polishing slurries. The Examiner asserts that the Shimizu patent teaches uniform silica particles having a single particle size 17, 25, or 42 nm, a purity greater than 99.9% and a single crystal phase. Applicants maintain that the Examiner has failed to establish prima faice anticipation of Applicants' claimed invention over the Shimizu patent. Applicants respectfully request reconsideration of the rejection based on the following analysis.

In the abstract and example 1, the Shimizu patent discloses that the particles are "highly monodispersed." The term "highly" is a relative term that does not quantify the degree of uniformity. In response to Applicants' arguments regarding the term "highly," the Examiner asserted that "examples 1, 3 and 4 and figure 1 show the particles have a single or uniform particle size." See Office Action of August 8, 2003 at page 5. Applicants assert that the magnification of figure 1 is insufficient to evaluate the presence of smaller particles. However, even the particles that are visible have noticeable size differences and some agglomeration. As a result, the Examiner has failed to produce a reference that contains every element as set forth in Applicants' claims. Certainly, the Shimizu patent does not disclose all of the features of Applicants' claimed invention in the detail claimed. Consequently, the Examiner has failed to establish prima facie anticipation since the Examiner has failed to establish that the reference teaches the claimed particle size distribution.

With respect to crystallinity as claimed in Applicants' claim 30, Applicants cannot even find a description in the Shimizu patent that the particles are cystalline. If the particles are

amorphous, they cannot fall within the conditions of claim 30. Thus, claim 30 is clearly not prima facie anticipated by the Shimizu patent.

Since the Shimizu patent does not prima facie anticipate Applicants' claimed invention, Applicants respectfully request the withdrawal of the rejection under 35 U.S.C. § 102(b) as being anticipated by the Shimizu patent.

C. REJECTIONS UNDER 35 U.S.C. § 102(b) OVER THE ROSTOKER '194 PATENT OR THE ROSTOKER '715 PATENT

The Examiner rejected claims 1, 2, 6, 7, 9, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 102(b) over U.S. Patent 5,389,194 to Rostoker et al. (Appendix C, the Rostoker '194 patent) or under 35 U.S.C. § 102(e) over U. S. Patent 5,626,715 to Rostoker (Appendix D, the Rostoker '715 patent). The relevant disclosure of these two patents is essentially identical. Thus, Applicants consider these two Rostoker patents together. The Examiner maintains that the Rostoker patents disclose all of the claim elements. Applicants maintain that the Rostoker patents do not teach all of the claim elements and that to the extent that the Rostoker patents do teach the claim elements, the Rostoker patents do not enable the practice of Applicants' claimed invention. Applicants respectfully request reconsideration of the rejections based on the following analysis.

There are two related but distinct issues. The first issue is whether or not the Rostoker patents discloses Applicants' claimed invention. Applicants have presented strong evidence that the Rostoker patents do not disclose Applicants' claimed invention to a person of ordinary skill in the art. Thus, there is no prima facie anticipation. Secondly, even if the Rostoker patents disclose Applicants' claimed invention, Applicants have presented clear evidence that the Rostoker patents do not enable the practice of Applicants' claimed invention. This second issue was primarily developed during prosecution of the parent application before the same Examiner. Applicants

believe that either of these issues are dispositive with respect to patentability of the present invention.

1. The Rostoker Patents Do Not Teach Applicants' Claimed Invention

As an initial evaluation of a reference, one must determine what the reference teaches. The Rostoker patents discuss the polishing process to a significant degree. Obtaining the materials for performing the polishing are discussed in detail in three paragraphs in column 5, lines 29-56 of the '715 patent and in column 6, lines 25-56 of the '194 patent. The first paragraph states as follows:

> Recently, methods have been developed for controllably producing ultrafine-grained, or nanocrystalline, materials (typically, about 1-100 nm grain diameters). These new methods have made possible the production of new materials having substantially different physical and chemical properties than the large grained, or single crystal, counterparts having substantially the same chemical composition.

The next paragraph discusses in detail the Siegel patent process and materials. The third paragraph of the triad states as follows:

> Given the recent advances in methods of producing such nanocrystalline materials, numerous problems in areas such as polishing semiconductor substrates can now be addressed using these new nanocrystalline materials.

It seems clear that the Rostoker patent is directed to polishing of substrates using the materials of the Siegel patent.

With respect to the polishing materials of Rostoker patent, these are described at column 7, lines 4-27 as follows:

> According to the invention, the alpha aluminum oxide particles used for polishing exhibit the following characteristics. Preferably, the particle size "X" nm, and the distribution of particle sizes is controlled to within "Y" nm, and the particles used for polishing are "Z" percent (%) in the alpha phase, where:
>
> "X" is 10-100 nm, such as 10, 20, 30, 40 or 50 nm, and is preferably no greater than 50 nm; and

> "Y" is approximately "P" percent of "X", where "P" is 10%, 20%, 30%, 40% or 50%, and is preferably no greater than 50% to ensure a narrow (Gaussian) distribution of particle sizes about "X";
> "Z" is at least 50%, including at least 60%, 70%, 80% and 90%, and as high as 100%.
> A quality factor "Q" is inversely related to "Y", and is a measure of the distribution of particle sizes. "Q" can be calculated as the concentration of particles at the desired size "X", divided by the range of sizes of particles at 3 db (decibles) lower than "X". Preferably, the size distribution of alpha aluminum oxide particles used for polishing exhibits a "Q" of at least 10, including 10, 50, 100, 500, 1000, 5000, or 10,000 ("Q" is dimensionless).

The meaning of this quoted language is in dispute, as described in detail below.

The Rostoker patents, relied upon by the Examiner, are far from clear with respect to their claims or the subject matter in their specification. The Rostoker patents describe particle collections with characteristics relating to the particle size distributions. But the descriptions of the particle size distributions is unintelligible. Appellants have long pointed to internal inconsistencies in the description. Nevertheless, the Examiner maintains that this gobbledygook teaches Appellants' claimed invention with the further support of prophetic examples, described below.

Applicants have previously submitted a declaration of Dr. Singh which presents a factual basis for concluding that the value of Q in the Rostoker patent cannot be determined. A copy of the Declaration is in Appendix E. The declaration clearly demonstrates that Dr. Singh is an **expert** in regards to particle technology. Furthermore, the declaration presents a detailed factual basis of why the value of Q cannot be determined.

In response to the Singh Declaration, the Examiner points to prophetic example 3 at column 8, line 65 to column 9, line 4 of the '715 patent and column 10, lines 5-11 of the '194 patent. Even within the Examiner's view, the use of +/- terminology at most interprets one parameter of the particle size distribution. Within this +/- notation, the spread generally is a confidence interval based on a particular probability level. (See, Appendix F, which are pages

from a Quantitative Analysis text). The probability level is not specified. Thus, the +/- terminology does not exclude a tail in the distribution contrary to the subject matter of Appellants' claim 15 or 26 or necessarily indicate a clear specification of uniformity as in Applicants' claim 1. Furthermore, this language must be interpreted in the context of the detailed description of the particle size distribution based on the quality factor Q. The Examiner has not explained how to reconcile these descriptions. The references must be considered as a whole. When viewing the references as a whole, they simply do not teach the uniformity of the particles as specified in Applicants' claimed invention.

In summary, the Examiner has failed to present prima facie evidence that the Rostoker patents teach the subject matter of Applicants' claimed invention. Specifically, the Rostoker patent does not teach subject matter that falls within the particle uniformity of Applicants' claimed invention. Furthermore, to the extent that the Rostoker patents do teach this subject matter, the Rostoker patents do not enable the practice of Applicants' claimed invention.

2. The Rostoker Patents Do Not Enable Applicants' Claimed Invention

Even assuming *arguendo* that the Rostoker patent can be interpreted to describe Appellants' claimed invention, clear and convincing evidence of record indicates that the Rostoker patent is not enabling with respect to Appellants' claimed invention. The Rostoker patent only teaches the methodology of the Siegel patent for teaching how to make nanoparticles. In an Amendment dated June 1, 1999, Applicants presented evidence in the parent case that the Siegel patent did not teach an approach suitable for forming Applicants' claimed invention. The Examiner acquiested that the Siegel patent was not enabling with respect to Applicants' claimed invention. See, office action of June 22, 1999, Appendix G. In response, the Examiner noted in the Office Action of June 22, 1999 that Applicants had not presented evidence that removing nanosized particles in a desired size range could not be separated out. In particular, the Examiner indicated that it may have been well known to a person of ordinary skill in the art how to form the

desired particle size distribution. Applicants then submitted information down loaded from the Millipore Corporation web site. Millipore is a leader in filtration technology.

In an Amendment dated August 11, 1999, Applicants presented evidence that filtration using commercially available filters for the filtration of particle slurries for chemical-mechanical polishing would not be effective to produce collections of particles with the narrow range of particle sizes claimed by Applicants. In response, the Examiner noted that the Rostoker patent did not need to establish what was already known in the art. The Examiner asserted that Applicants had not "presented any evidence methods of removing nanosized particles not in the desired size range were not well known to one of ordinary skill in the art at the time Rostoker was filed." The Examiner then asserted that Applicants must establish that "the method of the '081 patent was the only known method [sic] methods to provide for controlled production of nanocrystals known before 5 February 1993." Office Action of April 18, 2000, page 2, Appendix H.

Applicants then submitted a Declaration by an **expert** in the field, Professor Rajiv Singh. A copy of this Declaration can be found in Appendix I. Professor Rajiv Singh explicitly addressed the Examiner's concerns regarding particle separation technology available to a person of ordinary skill in the art. Professor Singh further concluded that "the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from about 5 nm to about 200 nm and a distribution of diameters such that at least about 95 percent of the particles have a diameter greater than about 60 percent of the average diameter and less than about 140 percent of the average diameter" and that "the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from about 5 nm to 200 nm and effectively no particles with a diameter greater than about 5 times the average diameter". This conclusion was based on Professor Singh's extensive experience in the surface polishing field. Note that Professor Singh was a Thrust Leader of Chemical Mechanical Planarization of the Engineering Research Center at the University of Florida.

Applicants note that the Rostoker patent is silent with respect to having to perform any size separation. Thus, the Rostoker patent provides no guidance for a person of skill in the art to obtain particle collections with narrow particle size distributions. As a result, the existence of methods, the types of methods and the application of the methods for appropriately size separating the particles all must have been well known in the art for the Rostoker patent to be enabling. **Applicants submit a Declaration by Professor Singh as evidence that such separation methods were not well known in the art at the filing date of the Rostoker patent or as of the filing date of Applicants' application.** In view of this evidence that no methods were known in the art for removing nanoparticles to produce a collection of particles with a narrow size distribution, Applicants have established that the Rostoker patent is not enabling with respect to the production of particle size distributions disclosed and claimed by Applicants. Applicants have already gone well beyond their burden in this case, in view of the overwhelming evidence presented by Applicants.

The Examiner made a clear error of law in evaluating Appellants' rebuttal evidence. In particular, Appellants clearly rebutted the enablement of the disclosure of the Rostoker patent with respect to the practice Appellants' claimed invention without undue experimentation. The Examiner inappropriately and contrary to law shifted the burden to Appellants to prove patentability rather than the failure of the Rostoker disclosure to enable the practice of Appellants' claimed invention.

The proposition is well established that the cited art only renders a composition of matter or apparatus unpatentable to the extent that the cited art enables the disputed claims or, in other words, if the cited art provides a means of obtaining the claimed composition or apparatus. Assertions in a prior art reference do not support an anticipation or obviousness rejection unless the references place the claimed invention in the hands of the public. The Rostoker patents clearly did not place Applicants' claimed invention in the hands of the public. The Examiner has clearly failed to establish otherwise by a preponderance of the evidence in view of Applicants' evidence.

Applicants maintain that the Examiner has failed to establish prima facie anticipation and rebutted prima facie anticipation to the extent that such a case was established. Specifically, Applicants maintain that the deficiencies of the Rostoker patents apply equally to the expression of the narrow distribution of particle sizes in claim 1 and claims depending from claim 1, as well as with respect to the particle size distributions lacking a tail in claim 15 and claims depending from claim 15. Claims 26, 27 and 29-31 relate to silicon compounds. The Rostoker patents indicate without any support whatsoever, the similar silicon oxide particles can be formed. Thus, enablement of the Rostoker patents with respect to silicon compounds is even much weaker that with respect to aluminum oxide.

Applicants respectfully request withdrawal of the rejections of claims 1,3, 6-8, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 102(e) over the Rostoker '715 patent and under 35 U.S.C. § 102(b) over the Rosotker '194 patent.

4. REJECTION UNDER 35 U.S.C. § 103(a) OVER SHIMIZU AND SECONDARY REFERENCES

The Examiner rejected claims 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over the Shimizu patent in view of U.S. Patent 5,318,927 to Sandhu et al. (Appendix J, the Sandhu patent), the Rostoker '715 patent and the Rostoker '194 patent. The Examiner specifically asserted that "Shimizu et al teach the claimed polishing compositions comprising a dispersion of silica particles." However, as discussed above, the Shimizu patent does not establish a prima facie case of anticipation of Applicants' claimed invention in independent claim 26 because it fails to disclose all of the claimed elements. More specifically, the Shimizu patent does not disclose particles with properties specified in Applicants' claims. The Examiner cited the Sandhu patent, the Rostoker '715 patent and the Rostoker '194 patent for their teaching of aqueous and nonaqueous solutions for polishing surfaces. The secondary references do not

make up for the deficiencies of the Shimizu patent with respect to independent claim 26 and thus with respect to dependent claims 27 and 28. Therefore, the combined disclosures of the cited references do not establish a prima facie case of obviousness of Applicants' claimed invention. Applicants respectfully request reconsideration of the rejection of claims 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over the Shimizu patent in view of the Sandhu patent, the Rostoker '194 patent and the Rostoker '715 patent.

E. REJECTION UNDER 35 U.S.C. § 103(a) OVER ROSTOKER OR ROSTOKER ET AL.

The Examiner rejected claims 1, 2, 6-9, 12, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over either the Rostoker '194 patent or the Rostoker '715 patent. The Examiner asserted that "both of these references teach a method of polishing a semiconductor surface using a polishing composition composed of particles dispersed in an aqueous solution where the polishing is performed using a polishing pad." However, the Rostoker '194 patent and the Rostoker '715 patent, taken alone or together, do not establish a prima facie case of obviousness because they do not teach or suggest particles with the properties specified in Applicants' claims. The deficiencies of the Rostoker patents are described in detail above. The arguments apply with equal force to the obviousness issues in addition to the anticipation issues. Applicants respectfully the withdrawal of the rejection of claims 1, 2, 6-9, 12, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over the Rostoker '194 patent or the Rostoker '715 patent.

F. REJECTION UNDER 35 U.S.C. § 103(a) OVER SANDHU ET AL., ROSTOKER ET AL. AND ROSTOKER

The Examiner rejected claims 1-3, 6, 15 and 23-31 under 35 U.S.C. § 103(a) as being unpatentable over the Sandhu patent in view of the Rostoker '715 patent or the Rostoker '194 patent. The Examiner asserted that the Sandhu patent "teach[s] a method of smoothing a surface using a chemical-mechanic polishing composition comprising alumina or silica abrasive particles dispersed in either an aqueous or a nonaqueous solution." The Examiner cited the secondary references for disclosing conventional chemical mechanical polishing. The Examiner admitted that the Sandhu patent does not "teach the particle size characteristics for the taught abrasive particles." The Examiner then asserts that the Rostoker patent teach "chemical mechanical abrasive particles."

The extreme deficiencies of the Rostoker patents are described above. Since the Examiner is relying on the Rostoker patents to support this rejection, prima faice obviousness has clearly not been established. Applicants maintain that the deficiencies of the Rostoker patents applies equally to the narrow particle size distributions in claim 1 and claims depending from claim 1 as well as the particle distributions that lack a tail in claim 15 and claims depending from 15. The deficiencies of the Rostoker patent are particularly pronounces with respect to the silicon compounds claims in Applicants' claims 26, 27 and 29-31 since the Rostoker patent gives no information on how to obtain these particles.

Applicants respectfully request the withdrawal of the rejection of claims 1-3, 6, 15 and 23-31 under 35 U.S.C. § 103(a) as being unpatentble over the Sandhu patent in view of the Gutsche patent, the Rostoker '194 patent and the Rostoker '715 patent.

CONCLUSIONS AND REQUEST FOR RELIEF

Applicants submit that claims 1-4, 6-10, 12-15 and 23-31 are free of the cited references. Thus, Applicants respectfully request the reversal of the rejections of claims, and the allowance of claims 1-4, 6-10, 12-15 and 23-31.

Respectfully submitted,

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February 10, 2004
Date of Deposit

Peter S. Dardi, Ph.D.

APPENDIX A

PENDING CLAIMS

1. A polishing composition comprising a dispersion of particles, the particles comprising a non-silicon metal compound and having an average particle diameter from about 5 nm to about 50 nm and a distribution of diameters such that at least about 95 percent of the particles have a diameter greater than about 60 percent of the average diameter and less than about 140 percent of the average diameter.

2. The polishing composition of claim 1 wherein the particles are dispersed in an aqueous solution.

3. The polishing composition of claim 1 wherein the particles are dispersed in a nonaqueous solution.

4. The polishing composition of claim 1 wherein the non-silicon metal compound is selected from the group consisting of TiO_2, Fe_3C, Fe_7C_3, Fe_2O_3, Fe_3O_4, MoS_2, MoO_2, WC, WO_3 and WS_2.

6. A method of smoothing a surface comprising the step of polishing the surface with the polishing composition of claim 1.

7. The method of claim 6 wherein the polishing is performed with a polishing pad.

8. The method of claim 6 wherein the polishing is performed with a motorized polisher.

9. The polishing composition of claim 1 having a single crystalline phase with a uniformity of at least about 90 percent by weight.

10. The polishing composition of claim 9 wherein the non-silicon metal compound is selected from the group consisting of TiO_2, Fe_3C, Fe_7C_3, Fe_2O_3, Fe_3O_4, MoS_2, MoO_2, WC, WO_3 and WS_2.

12. The polishing composition of claim 9 wherein the particles have a single crystalline phase with a uniformity of at least about 95 percent by weight.

13. The polishing composition of claim 9 wherein the particles have a single crystalline phase with a purity of at least about 99 percent by weight.

14. The polishing composition of claim 9 wherein the particles have a single crystalline phase with a purity of at least about 99.9 percent by weight.

15. A polishing composition comprising a dispersion of particles, the particles comprising a non-silicon metal compound with an average particle diameter from about 5 nm to about 50 nm, wherein less than about 1 particle in 10^6 has a diameter greater than about five times the average diameter.

23. The polishing composition of claim 15 wherein the particles are dispersed in an aqueous solution.

24. The polishing composition of claim 15 wherein the particles are dispersed in a nonaqueous solution.

25. A method of smoothing a surface comprising polishing the surface with the polishing composition of claim 15.

26. A polishing composition comprising a dispersion of particles, the particles comprising a silicon compound with an average particle diameter from about 5 nm to about 45 nm, wherein less than about 1 particle in 10^6 has a diameter greater than about five times the average diameter.

27. The polishing composition of claim 26 wherein the particles are dispersed in an aqueous solution.

28. The polishing composition of claim 26 wherein the particles are dispersed in a nonaqueous solution.

29. The polishing composition of claim 26 wherein the silicon compound is selected from the group consisting of SiO_2 and SiC.

30. The polishing composition of claim 26 having a single crystalline phase with a uniformity of at least about 90 percent by weight.

31. A method of smoothing a surface comprising the step of polishing the surface with the polishing composition of claim 26.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Kumar et al.	
Applic No.: 09/085,514	
Filed : May 27, 1998	Group Art Unit: 1773
For : SILICON OXIDE PARTICLES	Examiner: K. Bernatz
Docket No.: 2950.02US01	

DECLARATION UNDER 37 C.F.R. § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

I HEREBY CERTIFY THAT THIS PAPER IS BEING SENT BY U.S. MAIL, FIRST CLASS, TO THE ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231, THIS

___ DAY OF _____, 20___.

_____
PATENT ATTORNEY

Sir:

I, Rajiv K. Singh, Ph.D., hereby declare as follows:

1. I am presently a Professor of Material Science and Engineering at the University of Florida at Gainesville. Apart from my academic responsibilities, I provide consulting services through R. K. Singh Consulting Inc.

2. I received my Ph.D. degree in 1989 in Material Science and Engineering from North Carolina State University, Raleigh, NC.

3. I have been on the faculty at the University of Florida since 1990. I was promoted to Associate Professor with tenure in 1995 and to full Professor in 1997. A copy of my Curriculum Vitae is attached.

4. My recent accomplishments include receiving a National Science Foundation Young Investigator Award in 1994 and the Hardy Gold Metal for Outstanding Contributions in Material Science in

1995. I was a Distinguished Visiting Professor/Scientist at National University of Singapore (1999) and National Institute for Materials and Chemical Research, Tsukuba, Japan (2000). I am a fellow of the American Society for Materials (ASM). I am the author or co-author of more than 300 scientific articles and conference proceedings. I have co-edited seven books and guest edited five journal issues.

5. I have organized over 15 international conferences in advanced processing of materials including nano-particle science and technology and chemical- mechanical polishing (CMP).

6. I have been the Associate Director of the Engineering Research Center for Particle Science and Technology, at the University of Florida from 1994 -2001. My prime responsibility at this position was to develop advanced techniques for characterization of particles.

7. I am under a Consulting Agreement with NanoGram Corporation to provide consulting services in the area of chemical-mechanical planarization. I am not a shareholder in NanoGram Corporation. Also, I have no interest in the present patent application.

8. I have been working in the area of surface polishing and material science relating to properties of inorganic particles for many years. My laboratory at the University of Florida has performed extensive experiments in particle properties and in surface polishing.

9. I have read carefully U.S. Patent 5,128,081 to Rostoker, U.S. Patent 5,128,281 to Siegel et al., U.S. Patent 5,846,310 to Noguchi et al., U.S. Patent 4,775,520 to Unger et

al., and a passage from Ullmann's Encyclopedia of Industrial Chemistry, Vol. A23 at pp. 635-639. In addition, I have read the pending claims of the above noted patent application entitled "SILICON OXIDE PARTICLES." I did not participate in any capacity with the preparation of the SILICON OXIDE PARTICLES patent application.

10. With respect to the Rostoker '081 patent, a theoretical type of distribution is described in the patent. This distribution as described by Rostoker has several internal inconsistencies, as described below. Additionally, this distribution described by Rostoker does not conform to any standard representation of distribution functions described in standard textbooks and standard references.

In the Rostoker distribution, X is the average particle size. Y relates to a range around X. However, Q is important since Q, in principle, defines the size distribution. Unfortunately, the discussion of Q is not internally consistent. Q is indicated in the patent to be a dimensionless quantity. Q is defined as the concentration of particles at "X" divided by a concentration of particles in a range 3dB lower than "X". The numerator of this expression has units of $\#/cm^3$, whereas the denominator term denoted by concentration of particles in a range of sizes 3dB below X has units of $\#/cm^2$. Thus, according to Rostoker's definition, Q is not dimensionless but has units of 1/cm or 1/length. For Q to be a dimensionless quantity, either both the quantities should be defined in a certain range (e.g., concentration range +1dB of X divided by concentration at range +1dB at X/2), or both the quantities should describe the concentration at specific values (e.g., at X and at 3dB below X).

Even if we assume that the patent described Q as ratios at concentrations at X and at 3dB below X (which is not the case

in the patent description), which makes Q dimensionless, there are several more inconsistencies. First, the particle size distribution is defined by only two points, which can be extrapolated into any distribution one might choose to elect. Secondly, if we define A as the point at which the concentration of particles in a range 3bd below x, then the concentration at A equals concentration at $X/10^{0.3}$. Then the concentration at A corresponds approximately to the concentration at X divided by 2. This value does not correspond to a Gaussian distribution, and the evaluation of A does not address the problems with the definition of Q. The Rostoker patent nowhere describes a 3 sigma (standard deviation) distribution. Also, the standard deviation cannot be defined for a distribution given in the patent.

It should be noted that the particle size distribution, as described in the Rostoker patent is not consistent with the particle size distributions that are frequently used in the standard particle size and technology books and publications. Examples of some of the standard book publications with which I am familiar are 1) A. Jillaventesa, S. Dapkunas and L.H. Lum, "Particle Size Characterization," NIST Recommended Practice Guide, NIST Special Publication, 960-1 (2001); 2) T. Allen, "Particle Size Measurement," 4th Edition, Chapman and Hall, London (1992); 3) B. H. Kaye and R. Trottier, Chemical Engineering, 99:84 (April 1995); 4) R. J. Hunter, "Foundations of Colloidal Science," Wiley (1998); 5) E. Kissa, "Dispersions, Characterization Testing and Measurement," and 6) B. V. Miller and R. Lines, CRC Critical Reviews in Analytical Chemistry, 20:75-116 (1988). Relevant pages from Reference 4 are attached.

The only source of powders described in the Rostoker '081 patent is the process described in the Siegel patent. However, the Siegel patent only describes the formation of nanocrystalline materials. In other words, the materials are polycrystalline materials with nanocrystalline domains. The

Siegel patent does NOT describe the formation of submicron particles. Furthermore, I am aware of no approaches for the formation of silica particles as claimed by NanoGram except for the NanoGram process, as described further below.

11. With respect to the Unger '520 patent, this patent describes the formation of a silica gel using a two-step process. I have considerable experience with reactions that form silica gels including the Stober process and processes similar to the Unger process, from work that has been performed in my lab in Gainesville. Also, the process that leads to the formation of silica particles from alkoxide precursors is well documented in the literature, such as the texts Sol Gel Science, by C. Jeffrey Brinker and G. Scherer, Academic Press (1990) and The Chemistry of Silica, by R. K. Iler, Wiley (1979). The first step in the Unger process uses the Stober process to form a silica gel.

In the second step, increasing the particle size and removal of the porosity further refines the sol. In both the Stober and Unger processes, the hydrolysis of the alkoxide precursors occurs in basic conditions leading to formation of sol as a result of hydrolysis, polymerization and condensation reactions. The sol particle in this process typically consists of partially coalesced small clusters that form porous structures. The clusters typically are made of trimers and tetramers of silicon-hydrogen-oxygen precursors such as $SiO(OH)_3$, $SiO_2(OH)_2$, $Si_4O_6(OH)_6$, $Si_4O_8(OH)_4$, etc. After the condensation process, the clusters contain a large number of silanol groups and siloxane bonds. Several workers have made extensive studies on the use of FTIR, NMR and Raman Spectroscopy to understand the formation of the particles. Articles by Lippert et al. and Zerda et. al. are attached.

The cluster-like aggregates making the sol particles are typically smaller than 50 nm, and have a high surface area due to formation of the porous structures. Because of the high

porosity the surface area of the sols are much larger than the theoretical calculated surface area. The Unger patent also shows that the surface area of the sols of 100 - 350 m^2/gm, which is typically nearly two orders of magnitude greater the theoretically calculated surface areas based on the size of the particle measured by standard techniques such as TEM, and light diffraction measurements. Thus the sols are chemically and structurally different from a non-porous silica particle which is typically obtained from the Nanogram process. Specifically, the sols may have significant chemical variation than silicon dioxides, and the aggregates do not have the uniformity described in the NanoGram claims.

12. With respect to the Noguchi patent, this patent describes the application of a coating onto the silica gel of the Unger patent. The Noguchi patent does not deal with the synthesis of silica particles.

13. Pyrolytic or flame produced process is a standard method to make small particles of silica, alumina, titania, etc. There are several references that show the details on the flame-produced process. Examples include 1) Ulmann's encyclopedia; 2) Ulrich, Combustion Science Tech. 4:47-57 (1971); 3) G. W. Scherer in Better Ceramics Through Chemistry, eds. C. J. Brinker et al. (North Holland, NY 1984); 4) D. W. Schaefer, Material Research Society Bulletin, 13:22-27 (1988); 5) J.E. Martin et al., Phys. Rev. A 33:3540-3543 (1986); 6) A. J. Hurd et al., Phys. Rev. A 35:2361-2364 (1987); 7) J. D. F. Ramsay, Colloidal Surfaces 18:207-221 (1986). Copies of References 2, 5 and 6 are attached for reference. In the flame oxidation process, the small particles, which are formed by the oxidation reaction initially aggregate with each other by a ballistic process which mean that the mean free path of the aggregating species is large, compared

to the cluster size. In the second phase of the growth process, once the particles are large compared to the mean free path the trajectories of the particles change from ballistic to Brownian motion. The meandering path of the Brownian motion encourages attachment of the incoming cluster to the target periphery reacting aggregates and ramified fractal structures. Standard techniques such as visible light scattering and small angle neutron scattering have been used to show that the fractal dimension of the particles is characteristic of the diffusion limited cluster aggregation. Depending on the residence time and reactor design, the size of the primary particles may vary from 20 nm to 200 nm.

Although the primary particle size of the pyrolytic silica can be small, the particles form hard aggregates that neck in the aggregates, which make them difficult to disperse. The neck formation has been determined from transmission electron micrography (TEM). Attempts to disperse these particles result in dispersion of clusters of the fused aggregates forming individual particles. There is no way to separate the fused aggregates because the fusing results in hard bonding. Workers in field unfortunately refer to the grains that are fused together as primary particles, even though the hard fusing of these grains prevents separation of the grains as distinct particles. The actual particles are the fused entities or cluster rather than the individual grains. Thus, the particles are very non-uniform even if they are formed from fused grains that may be relatively uniform.

As further support for observations from my direct experience, I have attached a TEM micrograph from my lab that provide documentary evidence of these materials formed by the process described in Ullmann's Encyclopedia. The particle have an average particle size of about 20 - 50 nm and cluster sizes on average of about 250 nm. Due to the hard fusing of these

particles, the aggregates do not have high uniformity.

14. In my experiences, I have not seen materials comparable to the materials claimed in the NanoGram patent application. Based on my extensive experience with surface polishing, I expect that the NanoGram materials will be very good materials for surface polishing since the performance is expected to depend on the uniformity of the polishing materials. Thus, the NanoGram silica particles fill a void in the types of materials available for surface polishing. While NanoGram has not commercially exploited their silica materials for surface polishing yet due to their efforts with other commercial activities, I expect that these materials will someday have a significant commercial role in improving surface polishing of substrates.

14. I declare that all statements made herein that are of my own knowledge are true and that all statements that are made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: Dec. 10' 01 By: Rajiv K. Singh

Rajiv K. Singh, Ph.D.

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Glenda Anderson
Name of Person Making Deposit

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Signature

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Research Interests:

Innovative processing of materials; Laser processing; thin films; transient thermal phenomena; superconducting and dielectric(low K and high K) thin films; diamond and related materials, rapid thermal processing of elemental and wide band gap semiconductors, chemical-mechanical planarization, particulate coatings;semiconductor processing; modeling of transient thermal processing; flat panel displays, Angstrom scale advanced materials characterization, oxide thin films & electronics, gallium nitride and diamond crystal growth, nanoparticle synthesis and processing, front and back end semiconductor cleaning, phosphors and flat panel displays, thin film batteries.

Education

Ph.D. Materials Science and Engineering, North Carolina State University, Raleigh, 1989
M.S. Materials Science and Engineering, North Carolina State University, Raleigh, 1987
B.S. Chemical Engineering, Jadavpur University, Calcutta, India, 1985

Positions Held

97-pre ***Professor***, Materials Science and Engr., University of Florida
94-pre ***Director***, Characterization Research Instrumentation and Testbed (CRIT) Facility, Engineering Research Center (ERC), University of Florida
96-pre ***Thrust Leader***, Chemical Mechanical Planarization (CMP), ERC Univ of Florida
94-pre ***Thrust Leader***, Engineered Particulates, ERC, Univ. Florida
95-97 **Associate Professor**, Materials Science and Engr., University of Florida
90- 94 ***Assistant Professor***, University of Florida, Gainesville, FL

Awards/Honors

2000 - ***Distinguished Visiting Scientist,*** NIRIM, Tsukuba, Japan
1999 ***Distinguished Visiting Professor***, National University of Singapore, Singapore
1998 ***Distinguished Visiting Professor,*** University of Osaka, Osaka, Japan
1995 ***Hardy Gold Medal*** from TMS/AIME for Outstanding Contributions in Materials Science
1994 ***NSF Young Investigator Award***
94-97 ***Visiting Fellow***, Center for Ultrafast Optical Science (CUOS), University of Michigan
1993 ***IEEE Senior Member*** Award
1991 ***IBM Faculty Development*** Award
1989 ***MRS Best Graduate Student*** Award
1985 ***Alumni Gold Medal*** for Best Overall Graduating Senior from the University
1985 ***Laha Silver Medal*** for Best Graduate from College of Engineering

Publications:

Over 293 papers (> 268 published/in print & 25 submitted for various materials science and engineering journals (*Science, Physical Review B,, Applied Physics Letters, Journal of Materials Research, Materials Science and Engineering B, etc.*) and Conference Proceedings. Published over 32

original, *principal author papers in* App. Phy. Lett. (The most cited electronic materials/applied physics based journal), and 7 papers published in Physical Review B

Invited and Contributed Talks

Presented more than **110** invited talks at international conferences (MRS, SPIE, TMS, APS, ASME, etc.) and academic and research institutions (MIT, Columbia, Purdue, ORNL, Westinghouse, etc.). Also group presented over **250** technical papers at international conferences

Books and Guest Editorships (Edited 5 books & Guest Editor of 5 Journal Issues)

(1) R. K. Singh, D. Norton, J Cheung and J. Narayan and L.D. Laude , *Eds "Laser Processing of Materials: Fundamentals and Advanced Applications*, MRS Proceedings Vol 397, Pittsburgh, PA, 1996

(2). N. M. Ravindra and R.K. Singh,"*Transient Thermal Processing of Materials*", TMS, Warrendale April. 1996

(3). K. Gonsalves, M. Baraton, J.. Chen, J. Akkara, R. K. Singh and H. Hofmann , "*Surface Controlled Nanoscale and Microscale Materials for High Value Added Applications*, MRS Proceedings Vol 501 , Pittsburgh, PA, March 1998

(4). R.K. Singh, D. Lowdnes, J. Narayan, D. Chrisey , T. Kawai, and E. Fogarassy, Editors, *Advances in Laser Ablation of Materials*", MRS Proceedings for Spring 1998 .

(5). R. K. Singh and D. Kumar, "*Advances in Pulsed Laser Deposition of Thin Films*", Kluwer publishers, (1998)

(1)*Guest Editor* of September 1994, Vol 23 issue of *Journal of Electronic Materials* titled " *Novel Issues in Photonic Materials*"

(2) *Guest Editor* of Jan,96, Vol 1 issue of *Journal of Electronic Materials* titled *"Ion and Laser Beam Processing of Electronic Materials"*

(3) Guest Editor of Materials Science and Engr. B, on *Laser Processing of Electronic Materials*, Jan 1997

(4) *Guest Editor* of November 1997 Issue of *Journal of Electronic Materials* on *"Low Energy Beam Processing of materials."*

(5)*Guest Editor* of September 1998 Issue of *Journal of Electronic Materials* on *"Chemical-Mechanical Polishing of Semiconductors.*

Teaching Accomplishments

Developed four new courses:"Beam-Solid Interactions", "Thin Films" & "Math. Methods", "Survey of Materials Analysis" in the graduate MS&E program

Graduated 12 Master's and 10 Ph.D Students; Presently thesis advisor to 9 Ph. D Students

8 students awarded best paper/fellowships for their undergraduate/graduate research projects.

Developing CD-ROM materials and multi-media classroom for the NSF ERC project.

Established ParTiN (Particle technology) Hypertext Network for educational &ERC programs on the WWW (World Wide Web)

Corporate Interactions

Direct Research Interactions with several companies including IBM, Intel, Motorola, Ashland Chemical, Westinghouse, Lucent Technology, Applied Materials, Sony, Glaxo Wellcome, Lockheed Martin, Astra Zeneca, Purdue Pharma

Licensing Discussions with Sony, Nara Machinery, Astra Zeneca, Glaxo, etc.

Corporate funding over 200 K/yr .

Copyrighted Softwares (3 copyrighted softwares) including

(A) **SLIM** (*Simulation of Laser Interaction with Materials*, 36,000 coded lines, 1992) software. This first of its kind software is being used by more than 50 R&D groups (IBM, LANL, ORNL, etc.) in the world. This software calculates the transient thermal induced laser effects like melting, crystallization and ablation of materials. This software has had sales greater than $ 60 K worldwide in the last four years. Two new versions (one based on DOS C^{++} and the other on Windows platform) have been developed..

Patents (from a total of 30 disclosures:[14 patents, 10 awarded/pending(final stage) and 4 filed])

(1) ***High Surface Area Metals and Ceramics*** [US Patent 5,473,138] . A unique laser technique has been developed to increase the surface areas of ceramics, metals and composites. This technique involves the use of multiple-pulse laser irradiation under controlled energy window conditions.

(2) ***Enhanced Chemical Vapor Deposition of Diamond*** [US Patent 5,485,804 {1996}, Filed for worldwide patent} Novel colloidal method for large area nucleation, of diamond. *This method has been used to make the world's largest single monolithic piece of diamond which has a diameter greater than 11" and weighs over 1600 carats.*

Conference Chairs [Organized **16 international conferences** on innovative processing and characterization of materials]

(1) Chair of Symposium. on "Beam Processing of Materials", ***TMS/AIME Winter meeting***, Chicago Nov 92;

(2)Co-Chairman of Symposium on "Innovative Processing of Electronic and Photonic Materials" ***TMS/AIME Annual Meeting***, Denver, Feb 1993;

(3) Chairman of Conference on "Advanced Laser Processing of Materials" ***Engineering Foundation*** Conf., Palm Coast, FL, May 1-6 1994:

(4)Chair of Symposium on " Ion Beam Processing of Materials" ***TMS Spring Meeting***, LasVegas, Feb 1995

(5) Co-Chair of symposium on "Laser Processing of Materials" ***American Physical Society***, San Diego, March 1995

(6) Chair of Symposium on " Advanced Laser Processing of Materials: Fundamentals and Advanced Applications" **MRS Meeting**, Boston Nov 1995

(7) Co-Chair, Symposia on "Transient Thermal Processing of Materials", **TMS Annual Meeting**,Anaheim, CA Feb, 1996

(8)Chairman of symposium on, " Low Energy Beam Processes", **TMS Annual Meeting**, Orlando , FL Feb, 1997

(9)Chairman of symposium on " Particulate Coatings", **MRS Fall Meeting**, Boston November, 1997

(10) Co-Chairman of " Laser and Ion Beam Processing of Materials", **International Union of Materials Research Societies (IUMRS)**, Chiba, Japan, September 1997

(11) Co-Chairman," Transient Thermal Processing of Materials , **TMS Annual Meeting**, San Antonio, Feb 1998

(12) Co-Chairman," Chemical Mechanical Planarization of Materials Symposia, **TMS Annual Meeting**, San Antonio, Feb 1998

(13) Chairman, " Advances in Pulsed Laser Ablation of Materials", **MRS Spring Meeting**, San Francisco, April, 1998

(14) Co-Chairman, " Particulate Coatings" **5th World Congress on Particle Science and Technology**, Brighton UK, July 1998

(15) Co-Chairman " Rapid Thermal Processing of Materials"- **European MRS Meeting,** Strasbourg, June, 1998

(16) Chairman, "Chemical Mechanical Polishing Symposia", ***MRS Spring Meeting***, San Francisco, April 2000

Invited Review Articles

1 "*Pulsed Laser Deposition of Thin Films*", *Materials Science and Reports*" in March, (1998)

2. "SLIM,. A Personal Computer Based Simulation of Laser Interaction With Materials", *J Journal of Materials*, 44, 20 (1992)

3. " Pulsed Laser Deposition and Processing of Superconducting Thin Films", *J. of Materials* 43, 13 (1991)

Book Chapters

1. D. Gilbert and R. K. Singh, " Boron Nitride Interfaces", in " *Properties of Group III Nitrides*, Edited by James Edgar, *Imspec* publication, London 1995 2. R. K. Singh, " Raman Based Optical Properties of YBaCuO Surfaces", in " *Optical Properties of Materials*", Eds R. Hummel, CRC Press, 1996

3. R.K. Singh and D. Kumar, "Pulsed Laser Deposition of Superconducting Thin Films", *Materials Science and Engr. Reports* (in press, 1996)

4. R. K. Singh and D. Kumar, " Thermal Annealing of Semiconductors", *Encyclopedia of Applied Physics*, VCH Publishers (1996)

5. D. Gilbert and R. K. Singh, " Diamond Deposition for Electronic Applications", Eds . S. Pearton on *Wide Band Gap Semiconductors*", VCH Publishers 1997

)

Reviews

Reviewer for NSF, DOE, Physical Review B, Materials Science and Engineering, Journal of Applied Physics, Applied Physics Letter, Journal of Materials Research and Physica C. Invited to serve as panel members for several NSF initiatives

Memberships and Committee Chairmanships:

Member of MRS, ASM, TMS, IEEE (senior member), APS, AICHE, SPIE
Chairman: Thin Films and Interfaces Committee , TMS (1993 -1996)
Member: Laser Processing of Materials Committee, CLEO

Institutional Impact

(A) Helped establish the 60 million, NSF Funded ***Engineering Research Center (ERC)*** on particle science and technology at the University of Florida:

(B) Leader of team for the NSF MRSEC Proposal submitted in 1995 & 1997

(C)Established cross-disciplinary multi P.I programs in Rapid Thermal Processing, Particle Coating Technology, Radiation Damage in Electronic Devices, and Beam Processing of Materials:

(D) Established industrial and scientific collaborations with various institutions:

(E) Established international collaborations with

(i) CNRS, Strasbourg France, (ii) University of Melbourne, Australia, (iii) University of Osaka, Japan, (iv) Keio University, Japan, (v) EPFL, Lausanne, Switzerland, (vi) Unicamp, Sao Paulo Brazil, (vii) National University, Singapore.

3rd EDITION

QUANTITATIVE ANALYSIS

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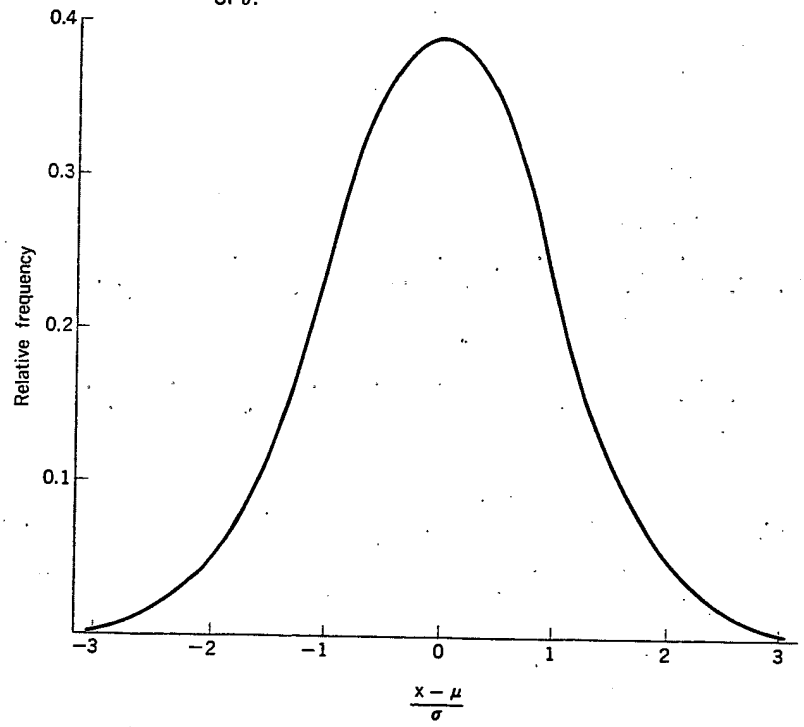
The Normal Error Curve

The limiting case approached by the frequency polygon as more and more replicate measurements are performed is the *normal* or *Gaussian* distribution curve, shown in Fig. 3.2. This curve is the locus of a mathematical function which is well-known, and it is more easily handled than the less ideal and more irregular curves that are often obtained with a smaller number of observations. Data are often treated as though they were normally distributed in order to simplify their analysis, and we may look upon the normal error curve as a model which is approximated more or less closely by real data. It is supposed that there exists a "universe" of data made up of an infinite number of individual measurements, and it is actually this "infinite population" to which the normal error function pertains. A finite number of replicate measurements is considered by statisticians to be a sample drawn in a random fashion from a hypothetical infinite population; thus the sample is at least hopefully a representative one, and fluctuations in its individual values may be considered to be normally distributed, so that the terminology and techniques associated with the normal error function may be employed in their analysis.

FIGURE 3.2 Normal distribution curve; relative frequencies of deviations from the mean for a normally-distributed infinite population; deviations $(x - \mu)$ are in units of σ.



The equation of the normal error curve may be written for our purposes as follows:

$$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/2\sigma^2}$$

Here y represents the relative frequency with which random sampling of the infinite population will bring to hand a particular value x. The quantities μ and σ, called the population parameters, specify the distribution. μ is the *mean* of the infinite population, and since we are not here concerned with determinate errors, we may consider that μ gives the correct magnitude of the measured quantity. It is clearly impractical to determine μ by actually averaging an infinite number of measured values, but we shall see below that a statement can be made from a finite series of measurements regarding the probability that μ lies within a certain interval. To the extent of our confidence in having eliminated determinate errors, such a statement approaches an assessment of the true value of the measured quantity. σ, which is called the *standard deviation*, is the distance from the mean to either of the two inflection points of the distribution curve, and may be thought of as a measure of the spread or scatter of the values making up the population; σ thus relates to precision. π has its usual significance and e is the base of the natural logarithm system. The term $(x - \mu)$ represents simply the extent to which an individual value x deviates from the mean.

The distribution function may be normalized by setting the area under the curve equal to unity, representing a total probability of one for the whole population. Since the curve approaches the abscissa asymptotically on either side of the mean, there is a small but finite probability of encountering enormous deviations from the mean. A person who happened to encounter one of these in performing a series of laboratory observations would be unfortunate indeed; some of us who have faith in never obtaining such a "wild" result in our own work are inclined to the view that the normal distribution as a model for real data breaks down, and that only the central region of the distribution curve is pertinent when applied to scientific measurements by competent workers. The area under the curve between any two values of $(x - \mu)$ gives the fraction of the total population having magnitudes between these two values. It may be shown that about two-thirds (actually 68.26%) of all the values in an infinite population fall within the limits $\mu \pm \sigma$, while $\mu \pm 2\sigma$ includes about 95% and $\mu \pm 3\sigma$ practically all (99.74%) of the values. Happily, then, small errors are more probable than large ones. Since the normal curve is symmetrical, high and low results are equally probable once determinate errors have been dismissed.

When a worker goes into the laboratory and measures something, we suppose that his result is one of an infinite population of such values that he might obtain in an eternity of such activity; then the chances are roughly 2 to 1 that his measured values will be no further than σ from the mean of the infinite population, and about 20 to 1 that his result will lie in the range

$\mu \pm 2\sigma$. In practice, of course, we can never find σ for an infinite population, but the standard deviation of a finite number of observations may be taken as an estimate of σ. Thus we may predict something about the likelihood of occurrence of an error of a certain magnitude in the work of a particular individual once he has performed enough measurements to permit estimation of the characteristics of his particular infinite population.

STATISTICAL TREATMENT OF FINITE SAMPLES

Although there is no doubt as to its mathematical meaning, the normal distribution of an infinite population is a fiction so far as real laboratory work is concerned. We must now turn our attention to techniques for handling scientific data as we obtain them in practice.

Measures of Central Tendency and Variability

The *central tendency* of a group of results is simply that value about which the individual results tend to "cluster." For an infinite population, it is μ, the mean of such a sample. The *mean* of a finite number of measurements, $x_1, x_2, x_3, \ldots, x_n$, is often designated $\bar{x}$ to distinguish it from μ. Of course $\bar{x}$ approaches μ as a limit when n, the number of measured values, approaches infinity. Calculation of the mean involves simply averaging the individual results:

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \cdots + x_n}{n} = \frac{\sum_{i=1}^{i=n} x_i}{n}$$

The mean is generally the most useful measure of central tendency. It may be shown that the mean of n results is $\sqrt{n}$ times as reliable as any one of the individual results. Thus there is a diminishing return from accumulating more and more replicate measurements: The mean of four results is twice as reliable as one result in measuring central tendency; the mean of nine results is three times as reliable; the mean of twenty-five results, five times as reliable, etc. Thus, generally speaking, it is inefficient for a careful worker who gets good precision to repeat a measurement more than a few times. Of course the need for increased reliability, and the price to be paid for it, must be decided on the basis of the importance of the results and the use to which they are to be put.

The *median* of an odd number of results is simply the middle value when the results are listed in order; for an even number of results, the median is the average of the two middle ones. In a truly symmetrical distribution, the mean and the median are identical. Generally speaking, the median is a less efficient measure of central tendency than is the mean, but in certain instances it may be useful, particularly in dealing with very small samples.

Since two parameters, μ and σ, are required to specify a frequency distribution, it is clear that two populations may have the same central tendency

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IM62/0622

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Commissioner of Patents and Trademarks

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Office Action Summary	Application No. 08/961,735	Applicant(s) Kambe et al
	Examiner Melissa Koslow	Group Art Unit 1755

☒ Responsive to communication(s) filed on *3 Jun 1999*.

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *three* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-16 and 23-26* is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☒ Claim(s) *16, 25, 26* is/are allowed.

☒ Claim(s) *1-15, 23 and 24* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *10*

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

This action is in response to applicants' amendment of 3 June 1999. The objections to the drawings and the specification are withdrawn. The art rejections over Fiato and Majetich et al are withdrawn in view of the amendments to the claims. Applicant's arguments with respect to the remaining rejections have been fully considered but they are not persuasive.

The attempt to incorporate subject matter into this application by reference to the article by Bi et al discussed on page 8 is improper because it is a publication and the incorporated subject matter appears to be essential.

The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper. Applicant is required to amend the disclosure to include the material incorporated by reference. Or to indicate the material be incorporated is not essential. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or a practitioner representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973).

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 2 and 4-15, 23 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Rostoker.

This reference teaches a polishing composition comprising a dispersion of alumina or silica particles. The taught particles have an average diameter of 10-100 nm and a distribution where preferably 100% of the particles have a diameter within 50% of the average particle diameter, preferably 40% of the average diameter. This means the distribution of diameters such that 100% have a diameter greater than 40% of the average diameter and less than 140% of the average diameter. It is clear none of the taught particles have a diameter greater than about 5 times the average particle size. The examples state the that particles are used in any of chemical-mechanic polishes discussed, which means the reference teaches the particles are dispersed in an aqueous medium. While the reference does not explicitly teach using a motorized polisher, the fact the articles being polished are semiconductor wafers and the type of polishing is chemical-mechanical polishing means the reference implicitly teaches using a motorized polisher. This is because chemical-mechanical polishing of semiconductor wafers are conventionally polished using a motorized chemical-mechanical polisher. The claimed composition and process read upon the taught compositions and process.

Applicants argue the patent to Rostoker is not enabling. Applicants have not presented any evidence the patent is not enabled. The fact the Siegel et al reference produces particles which have a particle size distribution broader that taught by Rostoker does not mean the reference is not enabling. Applicants have not presented any evidence methods of removing nanosized particles not in a desired particle size range were not well known to one of ordinary skill in the art at the time Rostoker was filed. Enablement does not require specific disclosure of what is already

known to one of ordinary skill in the art. *Case v. CPC International Inc.* 221 USPQ 196, 201 (Fed. Cir. 1984). A specification need not teach what is old or well known to those of ordinary skill in the art. *Case v. CPC International Inc.* 221 USPQ 196 (Fed. Cir. 1984); *In re Myers* 161 USPQ 668 (CCPA 1969); *In re Nelson* 126 USPQ 242 (CCPA 1960).

Applicants argue the statement the particles have a narrow (gaussian) distribution means that particles have a distribution that has a large tail corresponding to a small but significant number of particles with diameters considerably larger than average. Applicants have not presented any evidence to support this assertion. The conventional definition of gaussian distribution is the distribution curve has the shape of a normal probability curve, i.e., a bell curve. There is nothing in this definition which means the taught distribution has a large tail corresponding to a small but significant number of particles with diameters considerably larger than average. The definition means the taght distribution curve has the same shape as the distributions curves taught in the supplied article by Siegel et al and the supplied advertisement. The rejection is maintained.

Claims 1-6, 9-15, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandhu et al in view of Rostoker.

Sandhu et al teach a chemical-mechanical polish for semiconducting substrates comprising abrasive particles dispersed in either aqueous or non-aqueous solutions. The preferred particles are silica or alumina particles. Sandhu et al does not teach the particle size characteristics for the abrasive alumina or silica particles, which suggests to one of ordinary skill particles have any

particle size characteristics known to be used in chemical-mechanical polishes for semiconducting substrates. One of ordinary skill in the art would have found it obvious to use the particles of Rostoker as the abrasive alumina or silica particles in the dispersion of Sandhu et al. This is because Rostoker teaches the taught particles can be used in any chemical-mechanical polish for semiconducting substrates. Thus the references suggest the claimed composition and process.

Applicants' arguments with respect to this rejection is based on their arguments addressing the rejection over Rostoker. Since that argument is not convincing for the reasons cited above, the argument addressing this rejection is also not convincing. The rejection is maintained.

Claims 16, 25 and 26 are allowable over the cited art of record.

There is no teaching nor suggestion in the cited art of a polishing composition comprising an aqueous dispersion of metal carbide or metal sulfide particles, where the particles have an average particle size from about 5 to about 200 nm.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melissa Koslow whose telephone number is (703) 308-3817. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 4:30 PM. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Bell, can be reached at (703) 308-3823.

The fax phone number for Amendments filed under 37 CFR 1.116 or After Final communications is (703) 305-3599. The fax number for all other official communications is (703) 305-5408.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661 or (703) 308-0662.

cmk
June 21, 1999

C. Melissa Koslow
Primary Examiner
Tech. Center 1700

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/961,735	10/31/97	KAMBE N	08510/015001

IM62/0418

PETER S. DARDI, PH.D
WASTMAN, CHAMPLIN & KELLY
INTERNATIONAL CENTRE, SUITE 4[illegible]
900 SECOND AVENUE SOUTH
MINNEAPOLIS MN 55402-3319

RECEIVED
APR 21 2000
By

EXAMINER	
KOSLOW, C	

ART UNIT	PAPER NUMBER
1755	20

DATE MAILED: 04/18/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

DOCKETED
RESPONSE DUE 10-18-00
CALENDARED
CHECKED BY ATTY
10-16-00

Office Action Summary	Application No. 08/961,735	Applicant(s) KAMBE ET AL.	
	Examiner C. Melissa Koslow	Art Unit 1755	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

1)☒ Responsive to communication(s) filed on *31 March 2000* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16 and 23-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *16,25 and 26* is/are allowed.

6)☒ Claim(s) *1-15, 23 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a)☐ All b)☐ Some * c)☐ None of the CERTIFIED copies of the priority documents have been:

1.☐ received.

2.☐ received in Application No. (Series Code / Serial Number) _____ .

3.☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

14) ☐ Notice of References Cited (PTO-892)
15) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
16) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
17) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
18) ☐ Notice of Informal Patent Application (PTO-152)
19) ☐ Other:

This action is in response to applicants' response of 31 March 2000. Applicant's arguments have been fully considered but they are not persuasive.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 2 and 4-15, 23 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Rostoker.

This reference teaches a polishing composition comprising a dispersion of alumina or silica particles. The taught particles have an average diameter of 10-100 nm and a distribution where preferably 100% of the particles have a diameter within 50% of the average particle diameter, preferably 40% of the average diameter. This means the distribution of diameters such that 100% have a diameter greater than 40% of the average diameter and less than 140% of the average diameter. It is clear none of the taught particles have a diameter greater than about 5 times the average particle size. The examples state the particles are used in any of chemical-mechanic polishes discussed, which means the reference teaches the particles are dispersed in an aqueous medium. While the reference does not explicitly teach using a motorized polisher, the fact the articles being polished are semiconductor wafers and the type of polishing is chemical-mechanical polishing means the reference implicitly teaches using a motorized polisher. This is because chemical-mechanical polishing of semiconductor wafers is conventionally polished using a motorized chemical-mechanical polisher. The claimed composition and process read upon the taught compositions and process.

Applicants argue the patent to Rostoker is not enabling. Applicants have not presented any evidence the patent is not enabled and have provided a declaration Dr. Singh stating he is unaware of any processes which would allow one of ordinary skill in the art to produce the particle size distribution taught in Rostoker. Applicants are reminded every patent is presumed valid (35 U.S.C. 282), which means they are presumed enabled (*Metropolitan Eng. Co. v. Coe*, 78 F.2d 199, 25 USPQ 216 (D.C.Cir. 1935). Affidavits or declarations attacking the operability of a patent cited as a reference must rebut the presumption of operability by a preponderance of the evidence. *In re Sasse*, 629 F.2d 675, 207 USPQ 107 (CCPA 1980). See MPEP 716.07. The single supplied declaration does not represent a preponderance of evidence. With respect to the applicants' arguments that the only possible method meant by the statement on lines 30-36 in column 5 is that of '081, applicants are referred to column 1, lines 25-32 of '081 which states that there are "recently" developed methods to provide for controlled production of nanocrystals, which implies there must be other "recently" developed methods to provide for controlled production of nanocrystals known in the art besides that of '081. Applicants have not provided any evidence that the method of '081 was the only known method methods to provide for controlled production of nanocrystals known before 5 February 1993. The rejection is maintained.

Claims 1-6, 9-15, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandhu et al in view of Rostoker.

Sandhu et al teach a chemical-mechanical polish for semiconducting substrates comprising abrasive particles dispersed in either aqueous or non-aqueous solutions. The preferred particles are silica or alumina particles. Sandhu et al does not teach the particle size characteristics for the abrasive alumina or silica particles, which suggests to one of ordinary skill particles have any particle size characteristics known to be used in chemical-mechanical polishes for semiconducting substrates. One of ordinary skill in the art would have found it obvious to use the particles of Rostoker as the abrasive alumina or silica particles in the dispersion of Sandhu et al. This is because Rostoker teaches the taught particles can be used in any chemical-mechanical polish for semiconducting substrates. Thus, the references suggest the claimed composition and process.

Applicants' arguments with respect to this rejection is based on their arguments addressing the rejection over Rostoker. Since the above argument is not convincing for the reasons cited above, the argument addressing this rejection is also not convincing. The rejection is maintained.

Claims 16, 25 and 26 are allowable over the cited art of record for the reasons set forth in the previous office action.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melissa Koslow whose telephone number is (703) 308-3817. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 4:30 PM. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Bell, can be reached at (703) 308-3823.

The fax phone number for Amendments filed under 37 CFR 1.116 or After Final communications is (703) 305-3599. The fax number for all other official communications is (703) 305-5408.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661 or (703) 308-0662.

cmk
April 18, 2000

C. Melissa Koslow
Primary Examiner
Tech. Center 1700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Kambe et al.	
Serial No.: 08/961,735	
Filed : October 31, 1997	Group Art Unit: 1755
For : ABRASIVE PARTICLES FOR SURFACE POLISHING	Examiner: C. Koslow
Docket No.: N19.12-0008	

DECLARATION UNDER 37 C.F.R. § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

I HEREBY CERTIFY THAT THIS PAPER IS BEING SENT BY U.S. MAIL, FIRST CLASS, TO THE ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231, THIS 23 DAY OF March, 2000.
Robert D. Paul
PATENT ATTORNEY

I, Rajiv K. Singh, Ph.D., hereby declare as follows:

1. I am presently a Professor of Material Science and Engineering at the University of Florida at Gainsville. Also, I am Associate Director of the Characterization, Research Instrumentation and Testbed Facility of the Engineering Research Center for Particle Science and Technology at the University of Florida. Apart from my academic responsibilities, I provide consulting services through R. K. Singh Consulting Inc.

2. I received my Ph.D. degree in 1989 in Material Science and Engineering from North Carolina State Univeresity, Raleigh, NC.

3. I have been on the faculty at the University of Florida since 1990. I was promoted to Associate Professor with tenure in 1995 and to full Professor in 1997. A copy of my Curriculum Vitae is attached.

4. My recent accomplishments include receiving a National Science Foundation Young Investigator Award in 1994 and the Hardy Gold Metal for Outstanding Contributions in Material Science in 1995. I was a Distinguished Visiting Professor/Scientist at National University of Singapore (1999) and National Institute for Materials and Chemical Research, Tsukuba, Japan (2000). I am the

author or co-author of more than 293 scientific articles and conference proceedings. I have co-edited five books and guest edited five journal issues.

5. I am under a Consulting Agreement with NanoGram Corporation to provide consulting services in the area of chemical-mechanical planarization. I am not a shareholder in NanoGram Corporation.

6. I have read carefully U.S. Patent 5,626,715 to Rostoker (the Rostoker patent) and the pending claims of the above noted patent application entitled "ABRASIVE PARTICLES FOR SURFACE POLISHING." I did not participate in any capacity with the preparation of the ABRASIVE PARTICLES FOR SURFACE POLISHING patent application.

7. I have been working in the area of surface polishing and material science relating to properties of inorganic particles for many years. Even though I have extensive knowledge of work relating to the processing and use of inorganic particles, I am unaware of any method suitable to separate a collection of nanoparticles to produce particles with a narrow size distribution as claimed in the present application, as of the October 31, 1997 filing date or the February 5, 1993 filing date of the Rostoker patent. In particular, I am very familiar with efforts to produce uniform particle sizes using filtration approaches. As of October 31, 1997 no filtration techniques were publicly available to produce inorganic nanoparticles with extremely narrow particle size distributions as disclosed and claimed in the ABRASIVE PARTICLES FOR SURFACE POLISHING application. To the best of my knowledge, there were no alternatives to filtration that could remove undesired particle sizes from nanoparticle collections.

8. Since no methods were publicly available to separate nanoparticles to produce collections of nanoparticles having the claimed narrow particle size distribution, the Rostoker patent does not enable a person of ordinary skill in the art to produce

abrasive particles with narrow particle size distribution indicated in the pending claims. Specifically, the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from about 5 nm to about 200 nm and a distribution of diameters such that at least about 95 percent of the particles have a diameter greater than about 60 percent of the average diameter and less than about 140 percent of the average diameter. Similarly, the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from 5 nm to 200 nm and effectively no particles with a diameter greater than about 5 times the average diameter.

11. I declare that all statements made herein that are of my own knowledge are true and that all statements that are made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: March 21 '2000 By: Rajiv K. Singh

Rajiv K. Singh, Ph.D.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Attorney Docket No.: 2950.01US02

Kambe et al. Confirmation No.: 6755

Application No.: 09/841,255 Examiner: C. M. Koslow

Filed: April 24, 2001 Group Art Unit: 1755

For: ABRASIVE PARTICLES FOR SURFACE POLISHING

BRIEF FOR APPELANTS

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from an Office Action dated October 28, 2002, in which claims 1-4, 6-10, 12-15 and 23-31 were finally rejected. A Notice of Appeal was filed on November 10, 2003.

REAL PARTY IN INTEREST

NanoGram Corporation, a corporation organized under the laws of the state of Delaware, and having offices at 2911 Zanker Road, San Jose, California, has acquired the entire right, title and interest in and to the invention, the application, and any and all patents to be obtained therefor, as per the Assignment, recorded at Reel 012089, Frame 0565 from the inventors to NeoPhotonics Corporation and an assignment from NeoPhotonics Corporation to NanoGram Corporation, recorded at Reel 013957, Frame 0076. Note that NeoPhotonics Corporation was formerly called NanoGram Corporation, and the present NanoGram Corporation was previously a wholly owned subsidiary of NeoPhotonics Corporation following the formal name change. The present NanoGram Corporation is now an independent corporation, but affiliated with the earlier NanoGram Corporation, now named NeoPhotonics Corporation.

RELATED APPEALS AND INTERFERENCES

Applicants have several other patent applications on appeal. In particular, briefs have been filed in cases 09/136,483 and 09/433,202, which have related subject matter and cited references. However, these cases are do not claim priority back to the present application, and the results of the different appeals do not necessarily interrelate. Nevertheless, the Appeal of 09/136,483 involves issues relating to patents to Rostoker and Declarations relating thereto. Specifically, a Declaration of record in the present application was submitted as evidence in the Appeal of 09/136,483. Following the issuance of a decision by the Board for 09/136,483 and a denial by the Board of a Request For Reconsideration, Applicants have appealed the case to the U.S. Court of Appeal For the Federal Circuit, which is pending.

STATUS OF THE CLAIMS

Claims 1-4, 6-10, 12-15 and 23-31, which are all of the pending claims, stand rejected. The pending claims are listed in Appendix A.

STATUS OF AMENDMENTS

All Amendments have been entered with the filing of the Appeal.

SUMMARY OF INVENTION

The present invention relates to highly uniform collections of a metal compound particles or silicon compound particles and polishing compositions formed from these highly uniform collections of particles. The collections of nanoparticles have an average particle sizes less than about 50 nm or less. The polishing compositions comprise a dispersion of the particles through a medium, which can be an aqueous or non-aqueous liquid. A feature of the particles in some

embodiments is that they have a distribution of primary particle sizes such that less than about 1 in one million (10^6) particle have a diameter greater than about five times the average particle diameter for the collection of particles. In other words, the particles are highly uniform in that the particles do not have a tail in the particle size distribution. In other embodiments, the particle have a narrow distribution of particle sizes relating to the peak of the particle size distribution.

The production of the claimed highly uniform collection of nanoparticles is enabled by the use of laser pyrolysis. Unlike standard chemical reactions under equilibrium conditions, in laser pyrolysis a light beam defines a reaction zone in which the reaction is driven to completion and rapidly quenched to yield the highly uniform particle size distribution. The extreme amount of heat in the reaction zone tends to dissociate reactants within the reaction zone. The species then recombine to form the product compositions. The reaction is rapidly quenched as the particles leave the reaction zone. This quenching terminates further reaction and corresponding particle growth. Since the reaction zone is small and well defined, the product particles are correspondingly uniform. The effectiveness of laser pyrolysis for forming highly uniform particles is described throughout the specification.

Pending independent claim 15 is directed to a highly uniform particle collection comprising non-silicon metal compounds having extremely high uniformity expressed through a cut off in the particle size distribution. Pending independent claim 26 is directed to highly uniform nanoparticles comprising a silicon compound having extremely high uniformity expressed through a cut off in the particle size distribution. In other words, the plot of particle diameters does not have a tail at large diameters. Specifically, less than one particle in one million particles have a diameter more than five times the average diameter. For further description of these uniform particle collections, see the specification, for example, at page 18, line 24 to page 20, line 14. Such particle collections can be used effectively in a variety of applications described in the specification, for example for surface polishing.

Pending claim 1 is directed to nanoparticles comprising a non-silicon metal compound having a narrow distribution of particles sizes near the average particle diameter. This narrowness in the particle size distribution is expressed as a sharp drop in the distribution of particle sizes away from the average particle size. This narrow distribution about the average is independent from the lack of a tail in the distribution, although they both relate to the particle size distribution and uniformity of the powders. Applicants have produced powders with a distribution of particle sizes that is both narrow near its peak and without a tail at larger distributions.

Other aspects of the invention relate to the polishing compositions. Highly uniform particle dispersions can be used advantageously for improve polishing of surfaces. For surfaces that include a plurality of different materials, the particles dispersions can be used to polish the surface to selectively remove one material at a high rate relative to another material. Improved polishing properties of dispersions form with highly uniform aluminum oxide particles formed by laser pyrolysis is described further in published PCT application WO 01/32799.

ISSUES

1. Whether claims 15, 23 and 25 are invalid under the judicial doctrine of obviousness-type double patenting over copending application 09/136,483?

2. Whether claims 1-4, 6, 15, 23-29 and 31 are invalid under the judicial doctrine of obviousness-type double patenting over copending application 09/433,202?

3. Whether claims 26, 29-31 are invalid under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 4,842,837 to Shimizu?

4. Whether claims 1, 2, 6, 7, 9, 15, 23, 25-27 and 29-31 are anticipated under 35 U.S.C. § 102(b) over U.S. Patent 5,389,194 to Rostoker et al. and whether claims 1, 2, 6, 7, 9, 15, 23, 25-27 and 29-31 are anticipated under 35 U.S.C. § 102(e) over U.S. Patent 5,626,715 to Rostoker?

5. Whether claims 27 and 28 are obvious under § 103(a) over the Shimizu patent in view of the Sandhu patent, the Rostoker '194 patent and the Rostoker '715 patent?

6. Whether claims 1, 2, 6-9, 12, 15, 23, 25-27 and 29-31 are obvious under § 103(a) over the Rostoker '194 patent or the Rostoker '715 patent?

7. Whether claims 1-3, 6, 15 and 23-31 are obvious under § 103(a) over the Sandhu patent in view of the Rostoker '194 patent and the Rostoker '715 patent?

GROUPING OF CLAIMS

1. Claims 1-4, 6-10 and 12-14 form a first claim group directed to a polishing composition and corresponding methods of polishing a surface with the polishing composition.

2. Claims 15 and 23-25 form a second claim group directed to a polishing composition with a specified uniformity of particles.

3. Claims 26-29 and 31 form a third claim group directed to a polishing composition comprising a silicon compound and corresponding methods of polishing a surface with the polishing compound.

4. Claim 30 forms a fourth group directed to highly uniform silica with a single crystalline phase with a uniformity of at least about 90 weight percent.

ARGUMENT

I. LEGAL BACKGROUND

The Court of Appeals for the Federal Circuit has exclusive appellate jurisdiction for cases arising under the patent law under 28 U.S.C. § 1295 (a)(1). Federal Circuit patent law is subject to review by the U.S. Supreme Court. The Federal Circuit has adopted as binding precedent all holding of its predecessor courts, the U.S. Court of Claims and the U.S. Court of Customs and Patent Appeals. South Corp. v. U.S., 215 USPQ 657 (Fed. Cir. 1982). Therefore, unless they have

been overruled en banc or by the Supreme Court, CCPA cases are binding precedent for the present appeal.

A. OBVIOUSNESS-TYPE DOUBLE PATENTING IN POST URUGUAY TRADE PERIOD

The judicially created doctrine of obviousness-type double patenting was established to prevent an improper timewise extension of rights to exclude under the patent laws. See, for example, MPEP 804 IIB and references therein. All patents issuing from applications filed after June 8, 1995 (six months after the Uruguay trade agreements were implemented in the Uruguay Round Agreements Act, referred to herein as the post-URAA period) have a patent term of twenty years from their earliest priority date subject to any patent term extension. The changes in patent term affect the application of obviousness-type double patenting since the foundation of obviousness-type double patenting relates to patent term. However, the issues raised herein evidently are ones of first impression in that the U.S. Supreme Court, the U.S. Court of Appeal for the Federal Circuit and the PTO Board of Patent Appeals and Interferences do not seem to have ruled on the subject. In other words, the law and procedures have not been changed to reflect the fundamental changes in patent term. In particular, Applicants assert that a pending patent application with a priority date after June 8, 1995 should not be rejected for obviousness-type double patenting over a later filed application/patent, but if the earlier filed application can be rejected for obviousness-type double patenting over a later filed application/patent, a two way test for obviousness should be applied.

Under the pre-URAA rules, a two way test for obviousness was applied to determine whether or not to reject a pending patent application for obviousness-type double patenting over a patent that was later filed if the applicant could not have filed the claims in a single application and there was administrative delay. Eli Lilly & Co. v. Barr Labs., 251 F.3d 955, 975 (Fed. Cir.

2001); In re Berg, 140 F.3d 1428, 1434 and 1435 (Fed. Cir. 1998). A two way test was similarly mandated in the case of a double patenting rejection over a later filed application not yet issued as a patent, for patent applications in circumstances in which there were administrative delays of the PTO in prosecuting the first filed application and the applicants could not have filed the conflicting claims in an earlier filed application. However, in the pre-URAA period a later filed application that issued before a first filed application expired first since term was based on issue date rather than filing date. This is no longer true unless the first filed application has a patent term extension. Thus, the circumstances are inherently different.

Under the two-way test, the examiner not only asks whether the particular application claims are obvious over the patent claims (or the claims of the later filed application), but the examiner also asks whether the patent claims are obvious over the application claims. In re Berg at 1432. If not, the application claims later may be allowed. Id. The one-way test applies if the application at issue is the later filed application, both applications are filed on the same day, or the applicant could have filed all of its claims in the first application but elected not to. MPEP 804 II.B.1.(a); In re Berg, at 1434. An applicant could have filed all of its claims in one application when the disclosure of the earlier filed application will support the claims in the later filed application. Id. This is consistent with the policy of granting an applicant a patent in exchange for disclosure to the public of all of the information relating to the invention; and thus, preventing an unjustified extension of the patent term by not disclosing all of the developments in one application. However, the two-way test was designed to prevent invalidity for obviousness-type double patenting where the applicants filed first for a basic invention but later for an improvement thereof. Id. at 1432. This is consistent with exchanging a patent for public disclosure of additional developments that were not known at the time of the initial basic invention.

Under the pre-URAA procedure, if the later filed application had not issued, the double patenting rejection is provisional. If the provisional double patenting rejection becomes the only remaining rejection, the double patenting rejection is withdrawn and the case allowed to issue. See MPEP 804 I.B. Of course post-URAA, if the application under consideration is the second filed application, it does not make sense to withdraw the obviousness-type double patenting rejection just because the first filed application has not issued since the second filed application will expire later regardless of when it issues unless there is patent term extension. But if the application under consideration is the first filed application, the provisional rejection does not make any sense in the first instance.

Below Applicants present an analysis of the post-URAA circumstance in view of statutory changes based on analogy with the relevant pre-URAA law summarized above and the new statutory scheme. Applicants conclude that the USPTO and the courts lack the authority to impose a non-statutory double patenting rejection of a previously filed application over a later filed application (or a corresponding issued patent) since such a rejection is contrary to the provisions of the patent term extension legislation. Even if the USPTO has the authority, a two-way obviousness test should be imposed unless the patentee could have presented the claims of the later filed application in the first filed application to be consistent with the judicial framework put into place for pre-URAA patent applications.

In the pre-URAA period, a later filed application that issued before a first filed application expired first. However, this is no longer true because the term of the patent is 20 years from the date of filing unless the first filed application has a patent term extension. 35 U.S.C. § 154. Thus, the post-URAA circumstances relating to term are inherently different. Under the current rules, the length of time an application remains in prosecution simply diminishes the effective length of the patent term accordingly. Id. at 1435, n9. Thus, the prosecution of a first filed application can never be an attempt to extend the term of a later filed

application. So in a post-URAA period, the policies underlying an obviousness-type double patenting rejection no longer apply to a patent application based on the later filing of another patent application.

In response to Applicants' argument in the Preliminary Amendment of September 6, 2002 that a first filed application could not be an attempt to extend the term of a later filed application, the Examiner asserted that two reasons compel the continued rejection for obviousness-type double patenting. Specifically, the Examiner indicated that the terminal disclaimer was compelled by the possibility of patent term extension under 35 U.S.C. 154(b) and the requirement of common ownership imposed by a Terminal Disclaimer under 37 C.F.R. 1.321(c). Applicants maintain that neither of these reasons are reasonable, and neither compels the filing of a Terminal Disclaimer in the present case.

Patent term extensions were designed by Congress to address delays in prosecution of a patent application in the Patent Office. Application of the double patenting rules, as suggested by the Examiner, would be contrary to the express language of the statue and the purpose of the patent term extension. The judicial doctrine of obviousness-type double patenting was long established when the present form of patent term adjustment was enacted by Congress. Since 35 U.S.C. 154 does not limit patent term adjustment, we can assume that Congress intended to overturn obviousness-type double patenting directed explicitly to limiting patent term adjustment. Neither the Patent Office nor the courts have the authority to circumvent statutory mandates. The statute could have been drafted by Congress to impose the double patenting limitation on the patent term adjustment, but was not. Therefore, even the use of a obvousness-type double patenting rejection is not allowed by statute to eliminate a statutory patent term adjustment.

With respect to the requirement of common assignment under a terminal disclaimer, this presumes a proper double patenting rejection. See In re Van Ornum, 214 USPQ 761, 763-767

(CCPA 1982). Applicants maintain that the obviousness-type double patenting rejection is not proper and should be withdrawn and that the requirement of common assignment is not fair under the present circumstances. A patent should not have to be terminally disclaimed over a later filed improvement patent to impose a requirement that they remain commonly owned. This is especially clear without the imposition of a two-way test for establishing obviousness-type double patenting.

B. ANTICIPATION

1. Examiner's Burden

The Examiner has the burden of establishing a prima facie case of anticipation. As such, the Examiner must provide a reference that discloses every element as set forth in the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F2d. 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) (MPEP §2131).

2. A Single Reference Must Identically Disclose Every Element Set Forth In a Claim To Anticipate The Claim

"In order to constitute anticipatory prior art, a reference must identically disclose the claimed compound..." MPEP 2122 citing In re Schoenwald, 22 USPQ2d 1671, (Fed. Cir. 1992). "For a prior art reference to anticipate in terms of 35 U.S.C. § 102, **every element of the claimed invention must be identically shown in a single reference**. These elements must be arranged as in the claim under review, but this is not an 'ipsissimis verbis' test." In re Bond, 15 USPQ2d 1566, 1567 (Fed. Cir, 1990)(Internal citations omitted and emphasis added.).

"If the prior art reference does not expressly set forth a particular element of the claim, that reference still may anticipate if that element is 'inherent' in its disclosure. To establish

inherency, the intrinsic evidence 'must make it clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'" In re Robertson, 49 USPQ2d 1949, 1950, 1951 (Fed. Cir. 1999), citing Continental Can Co. v. Monsanto Co., 20 USPQ2d 1746, 1749 (Fed. Cir. 1991).

"Every element of the claimed invention must be literally present, arranged as in the claim. **The identical invention must be shown in as complete detail as is contained in the patent claim.**" Richardson v. U.S. Suzuki Motor Corp., 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)(Internal citations omitted, and emphasis added.); see also MPEP 2131. "Here, as well, anticipation is **not** shown by a prior art disclosure which is only '**substantially the same**' as the claimed invention." Jamesbury Corp. v. Litton Industrial Products, Inc., 225 USPQ 253, 256 (Fed. Cir. 1985)(emphasis added).

Similar requirements also hold under an obviousness rejection. Prima facie obviousness is not established if all the elements of the rejected claim are not disclosed or suggested in the cited art. In re Ochiai, 37 USPQ 1127, 1131 (Fed. Cir. 1995). ("The test for obviousness *vel non* is statutory. It requires that one compare the claim's 'subject matter as a whole' with the prior art 'to which said subject matter pertains.'"). See also, MPEP 2143.03 "All Claim Limitations Must Be Taught or Suggested," citing In re Royka, 180 USPQ 580 (CCPA 1974). "To establish prima facie obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art." MPEP 2143.03.

3. Ranges

Claims covering a range of composition narrower than a broader range covered in the prior art are not anticipated, although they may be obvious over the prior art. In re Malagari, 182 USPQ

549, 553 (CCPA 1974). Such claims are analogous to the claim of a species or subgenus within a genus, which may be patentable and generally are not obvious. See MPEP 2131.02 and 2131.03.

4. To Support A Finding Of Unpatentability Based On Cited Art, The Cited Art Must Provide A Means Of Obtaining The Claimed Composition Or Apparatus

The proposition is well established that the cited art only renders a composition of matter or apparatus unpatentable to the extent that the cited art enables the disputed claims, in other words, if the cited art provides a means of obtaining the claimed composition or apparatus.

> To the extent that anyone may draw an inference from the Von Bramer case that the mere printed conception or the mere printed contemplation which constitutes the designation of a 'compound' is sufficient to show that such a compound is old, regardless of whether the compound is involved in a 35 U.S.C. 102 or 35 U.S.C. 103 rejection, we totally disagree. ... We think, rather, that the true test of any prior art relied upon to show or suggest that a chemical compound is old, is whether the prior art is such as to place the disclosed 'compound' in the possession of the public. In re Brown, 141 USPQ 245, 248-49 (CCPA 1964)(emphasis in original)(citations omitted).

Similarly, see In re Hoeksema, 158 USPQ 596, 600 (CCPA 1968)(emphasis in original):

> We are certain, however, that the invention as a whole is the claimed compound and a way to produce it, wherefore appellant's argument has substance. There has been no showing by the Patent Office in this record that the claimed compound can exist because there is no showing of a known or obvious way to manufacture it; hence, it seems to us that the 'invention as a whole,' which section 103 demands that we consider, is not obvious from the prior art of record.
>
> While there are valid reasons based on public policy as to why this defect in the prior art precludes a finding of obviousness under section 103, In re Brown, supra, its immediate significance in the present inquiry is that it poses yet another difference between the claimed invention and the prior art which must be considered in the context of section 103. So considered, we think the differences between appellant's invention as a whole and the prior art are such that the claimed invention would not be obvious within the contemplation of 35 U.S.C. 103.

The Federal Circuit has further emphasized these issues. Assertions in a prior art reference do not support an anticipation or obviousness rejection unless the references place the claimed invention in the hands of the public. Beckman Instruments Inc. v. LKB Produkter AB, 13 USPQ2d 1301, 1304 (Fed. Cir. 1989). "In order to render a claimed apparatus or method obvious, the prior art must enable one skilled in the art to make and use the apparatus or method." Id. While a properly citable reference is prior art for all that it teaches, references along with the knowledge of a person of ordinary skill in the art must be enabling to place the invention in the hands of the public. In re Paulsen, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994). See also In re Donohue, 226 USPQ 619, 621 (Fed. Cir. 1985). "[A] § 102(b) reference "must sufficiently describe the claimed invention to have placed the public in possession of it." Paperless Accounting, Inc. v. Bay Area Rapid Transit Sys., 804 F.2d 659, 665 (Fed. Cir. 1986), cert. denied, 480 U.S. 933 (1987)(quoting In re Donohue, 766 F.2d at 533). An enabling disclosure is one that allows a person of ordinary skill to practice the technology without undue experimentation based on the guidance in the disclosure along with what is well known in the art. In re Wands, 858 F. 2d 731, 737 (Fed. Cir. 1988).

See also, Ex parte Logan, 38 USPQ2d 1852, 1856 (BPAI 1994) (unpublished). While this Board case is not binding precedent or even published, it is probative of an appropriate analysis under the present facts. In Ex parte Logan, Id., the claims were rejected over a patent and a corresponding patent application. In response to the rejection, appellants argued that the cited patent and application were inoperable. In support of the appellants' assertions, a declaration was presented. The Examiner dismissed the declaration as mere opinion by an interested party. The Board in this case noted that the factual evidence presented in the declaration was probative of the issues. Furthermore, the Examiner did not offer any evidence or argument that the required modifications to make the previous invention functional would have been made by a person of ordinary skill in the art. The board concluded that the appellant had met their burden of rebutting the presumption of operability of the prior art patent by a

preponderance of the evidence. Id. In reaching this holding, the court expressly noted that, "the examiner has failed to shoulder his burden of rebutting the appellant's evidence of non-enablement/inoperability." Id.

The point is further taken in In re Payne, 606 F.2d 303, 315 (C.C.P.A. 1979) (citing In re Hoeksema, 399 F.2d 269, 275 (CCPA 1968)), where the Court stated, "To successfully rebut the examiner's *prima facie* case of enablement, it was incumbent upon Payne [appellant] to introduce affidavits or other factual evidence in support of his position. ...facts set forth in an affidavit (37 CFR 1.132) of an expert in the field suggesting that inoperativeness, would be highly probative." Id. (citations omitted).

C. OBVIOUSNESS

1. The Examiner bears the burden of demonstrating nonobviousness.

The Applicants note that the patent office has the burden of persuasion in showing that the Applicants are not entitled to a patent. "[T]he conclusion of obviousness vel non is based on the preponderance of evidence and argument in the record." In re Oetiker, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992). The patent office has the ultimate burden of persuasion in establishing that an applicant is not entitled to a patent. Id. at 1447, concurring opinion of Judge Plager. **"The only determinative issue is whether the record as a whole supports the legal conclusion that the invention would have been obvious."** Id.

"In rejecting claims under 35 U.S.C. §103, the examiner bears the initial burden of presenting a prima facie case of obviousness." In re Rijckaert, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). Prima facie obviousness is not established if all the elements of the rejected claim are not disclosed or suggested in the cited art. In re Ochiai, 37 USPQ 1127, 1131 (Fed. Cir. 1995). ("The test for obviousness *vel non* is statutory. It requires that one compare the claim's 'subject matter as a whole' with the prior art 'to which said subject matter pertains.'"). See also, MPEP 2143.03 "All

Claim Limitations Must Be Taught or Suggested," citing In re Royka, 180 USPQ 580 (CCPA 1974). "It is impermissible, however, to simply engage in a hindsight reconstruction of the claimed invention, using applicant's structure as a template and selecting elements from references to fill the gaps." In re Gorman, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991).

If the Examiner fails to establish a prima facie case of obviousness, the obviousness rejection must be withdrawn as a matter of law. In re Ochiai, 37 USPQ at 1131 ("When the references cited by the examiner fail to establish a prima facie case of obviousness, the rejection is improper and will be overturned.").

2. There Must Be Motivation In The Art To Modify The Teachings Of the Cited References

The motivation, or suggestion, to combine references must be either explicitly or implicitly in the references or knowledge "generally available to one of ordinary skill in the art." See, MPEP § 2143.01. Furthermore, "[t]he test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." See, MPEP §2143.01 (quoting In re Kotzab, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000)).

The Federal Circuit has provided considerable guidance on establishing obviousness of a claim based on a combination of references. "Our case law makes clear that the best defense against hindsight-based obviousness analysis is the rigorous application of the requirement of a teaching or motivation to combine the prior art references." *Ecolochem Inc. v. Southern Edison*, 56 USPQ2d 1065, 1073 (Fed. Cir. 2000). "Therefore, '[w]hen determining the patentability of a claimed invention which combines two known elements, 'the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.' " *Id.* (quoting *In re Beattie*, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992)(quoting *Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co.*, 221

USPQ 481, 488 (Fed. Cir. 1984))). "In order to prevent a hindsight-based obviousness analysis, we have clearly established that the relevant inquiry for determining the scope and content of the prior art is whether there is a reason, suggestion, or motivation in the prior art or elsewhere that would have led one of ordinary skill in the art to combine the references." *Ruiz v. A.B. Chance Co.*, 57 USPQ2d 1161, 1167 (Fed. Cir. 2000). "**The test is not whether one device can be an appropriate substitute for another.**" *Id.* (emphasis added). In *Ruiz*, the Federal Circuit overturned a district court holding that "it would have been obvious to combine screw anchors and metal brackets, because the need for a bracket 'was apparent.'" *Id.*

When the modification of an apparatus renders the apparatus "inoperative for its intended purpose," the reference teaches away from the suggested modification. In re Gordon, 221 USPQ 1125, 1127 (Fed. Cir. 1984). "If when combined, the references 'would produce a seemingly inoperative device,' then they teach away from their combination." Tec Air Inc. v. Denso Manufacturing Michigan Inc., 52 USPQ2d 1294, 1298 (Fed. Cir. 1999)(citing In re Sponnoble, 160 USPQ 237, 244 (CCPA 1969)).

3. The References Must Provide A Reasonable Expectation Of Success

While a reference is prior art for all that it teaches, references along with the knowledge of a person of ordinary skill in the art must be enabling to place the invention in the hands of the public. In re Paulsen, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994). See also In re Donohue, 226 USPQ 619, 621 (Fed. Cir. 1985). "The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood success, viewed in light of the prior art." Micro Chemical Inc. v. Great Plains Chemical Co., 41 USPQ2d 1238, 1245 (Fed. Cir. 1997)(quoting In Re Dow Chemical Co., 5 USPQ2d 1529, 1531 (Fed. Cir. 1988)).

4. The References Must Teach Or Suggest All Of The Claim Elements

"To establish prima facie obviousness of a claimed invention, all of the claim limitations must be taught or suggested by the prior art." MPEP 2143.03.

5. Compositions Of Matter

It is long established that a composition of matter is indistinguishable from its properties. In re Papesch, 137 USPQ 43, 51 (CCPA 1963); In re Cescon, 177 USPQ 264, 266 (CCPA 1973). There are two types of properties, chemical/compositional properties and physical properties. The chemical/compositional properties of the composition of matter determine what the material is, while the physical properties relate to the interaction and behavior of the composition of matter. Often unique or unexpected physical properties are used to establish the existence of an unobvious composition when chemical/compositional properties either are unknown or do not fully represent the unobviousness of the composition. However, discovery of a surprising or unexpected physical property does not necessarily control an obviousness determination, and all the evidence under the Graham factors must be considered. See, for example, Richardson-Vicks v. Upjohn Co., 44 USPQ2d 1181, 1187 (Fed. Cir. 1997). **In the present case, the claims do not relate to the discovery of properties of previously known or suggested materials.**

6. Obviousness Over A Single Prior Art Reference

The importance of the principle that the prior art itself must suggest the motivation to modify the teachings of a reference was eloquently stated in In re Rouffet, 47 USPQ2d 1453, 1458 (Fed. Cir. 1998)(emphasis added):

> The Board did not, however, explain what specific understanding or technical principle within the knowledge of one of ordinary skill in the art would have suggested the combination. **Instead the board merely invoked the high level of skill in the field of the art. If such a rote invocation could suffice to supply a motivation to combine, the more sophisticated scientific fields would rarely, if ever, experience a patentable technical advance.** Instead, in complex scientific fields, the Board could routinely identify the prior art elements in an application,

> invoke the lofty level of skill, and rest its case for rejection. **To counter this potential weakness in the obviousness construct, the suggestion to combine requirement stands as a critical safeguard against hindsight analysis and rote application of the legal test for obviousness.**

Similar principles must be applied when obviousness is based on the teachings of a single cited reference.

> In appropriate circumstances, a single prior art reference can render a claim obvious. However, there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion. This suggestion or motivation may be derived from the prior art reference itself, from the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. **Determining whether there is a suggestion or motivation to modify a prior art reference is one aspect of determining the scope and content of the prior art, a fact question subsidiary to the ultimate conclusion of obviousness.**

Sibia Neurosciences, Inc. v. Cadus Pharmaceutical Corp., 55 USPQ2d 1927, 1931 (Fed. Circuit 2000)(internal citations omitted, emphasis added).

II. ANALYSIS

A. OBVIOUSNESS-TYPE DOUBLE PATENTING REJECTIONS

The two pending obviousness-type double patenting rejections are considered together since the legal error relating to these rejections are common to both rejections. In summary, the rejections of the pending claims were made under the judicial doctrine of obviousness-type double patenting of claims 15, 23 and 25 over copending application 09/136,483 and claims 1-4, 6, 15 and 23-25 over copending application 09/433,202. With all due respect, the Examiner misapplied a judicial doctrine applicable under pre-URAA law in situations following URAA modifications of patent term. The MPEP has not been appropriately modified in view of the changes in patent term.

The filing of a non-obvious improvement patent application does not convert the first filled patent application into a way to extend the term of the later filed improvement patent. A

patent applicant should not be punished for the patenting of improvements by the requirement of filing a terminal disclaimer that imposes a common ownership requirement. In addition, where does this requirement end? It is certainly now not the practice of filing terminal disclaimers for issued patents for every later filed improvement patent. But under current Patent Office practice, this should be done since there is no clear basis for when such a terminal disclaimer would or would not be appropriate. The implication is that the first filed claims are obvious over an improvement patent. Typically, the claims of the pioneering patent are obvious over the claims of the improvement patent. Thus, a patent would need to be terminally disclaimed over improvement patents that issue 10, 15 up to 20 years after its filing date.

The patent Examiner agued that a continuing rational is that the first filed application can get patent term extension. But the Examiner did not argue that patent term extension was a prerequisite for the imposition for the obviousness-type double patenting rejection. If a patent term extension of the application is a pre-requisite, this issue raised by the Examiner is not ripe since the present application has not issued. Thus, there is no patent term extension that would raise the obviousness-type double patenting issue. However, Applicants maintain that even if there is a patent term extension, there is no obviousness-type double patenting under the statutory scheme. Also, Congress instituted patent terms extension for carefully considered reasons. These should not be eliminated by the Patent Office without Congressional approval

Furthermore, the second filed applications have not issued as patents. The obviousness-type double patenting rejections are provisional. The provisional double patenting rejection should not prevent issuance of the patent, see MPEP 804 (I)(B). By analogy with the pre-URAA analysis, the Examiner has not asserted a proper provisional rejection since it must involve a two-way test under MPEP guidelines. Also, **requiring less than a two-way test would yield an unfair result.** If a later invention is filed on a non-obvious improvement, a patentee should not be required to file a terminal disclaimer for the broader parent invention based on the filing of

the non-obvious improvement patent. This requirement would discourage the invention and patenting of non-obvious improvements. Such a result is not reasonable nor was this the intention of Congress by the imposition of patent term extension.

In the pre-URAA situation, patent term was based on the issue date of a patent such that delays in prosecution were addressed by the reference point of the patent term. Under the present statute, if the first filed patent is delayed and obtains a term extended beyond the expiration of the later filed patent, this is analogous to the pre-URAA situation of MPEP II(B)(1)(b), in which the "issued patent" (i.e., the earlier expiring patent) is the later filed application. For these situations, a two-way obviousness test was required and still is required with respect to pre-URAA applications. If the claims of the later filed application are not obvious over the claims of the earlier filed patent application, the term of the second filed application is not being improperly extended by the patent term extension of the first filed application, and the double patenting rejection is improper.

The Examiner argued on page 5 of the Office Action of October 28, 2002 that "First, 35 U.S.C. 154(b) includes provisions for patent term extension based upon prosecution delays during the application process. Thus, 35 U.S.C. 154 does not ensure that any patent issuing on a utility or plant application filed on or after June 8, 1995 will necessarily expire 20 years from the earliest filing date for which a benefit is claimed under 35 U.S.C. 120, 121 or 365(c). Second, 37 CFR 1.321(c)(3) requires that a terminal disclaimer filed to obviate a judicially created patenting rejection including a provision that any patent is commonly owned with an application or patent which formed the basis for the rejection." Clearly, the Examiner's second reason is circular since the justification for a double patenting rejection cannot be that if there is a valid double patenting rejection the terminal disclaimer should require common assignment. This is an argument for structuring the terminal disclaimer and not for making a double patenting rejection in the first instance.

In the post-URAA, the only possible justification for an obviousness-type double patenting rejection of an application with an earlier priority date over an application with a later priority date is the term extension of the earlier application. However, the double patenting rejection negates the patent term extension contrary to the statute. Congress enacted the post-URAA patent term extension to account for patent term in the event of delays in prosecution in the patent office. The statute at 35 U.S.C. 154(b) provides for patent term extension. Congress did not provide in the statute for the diminution of the extension due to the filing of a later application, which is the direct and only effect of imposing an obviousness-type double patenting rejection on a patent application with an earlier priority dated over an application with a later priority date. Since Congress did not provide for attenuation of the mandated patent term extension under the long established principle of obviousness-type double patenting, the courts and the Patent Office do not have the authority to undermine the Congressionally granted patent term extension. Imposition of an obviousness-type double patenting rejection just to reduce the statutory patent term extension should be an issue for Congress. Furthermore, a patent term extension based on Food and Drug Administration approval under 35 U.S.C. 155 has never been suggested to be a basis for an obviousness-type double patenting rejection.

Under post-URAA patent term rules, an application with a later priority date expires later than a patent application with an earlier priority date unless there is an appropriately long patent term extension of the earlier patent application. Thus, without a patent term extension, the situation is analogous to the pre-URAA situation in which the later filed application issued first such that it had a later expiration date, **which did not result in an obviousness-type double patenting rejection of the first application over the later application**. See MPEP 804. An obviousness-type double patenting rejection of an earlier priority application over a later priority application is only reasonable (if ever) if the earlier application has an **actual** patent term extension such that it expires later than the later application.

Assuming Arguendo the courts and the Patent Office do have the statutory authority to impose an obviousness-type double patenting rejection of an application with an earlier priority date over an application, it can only be imposed after a determination is made that a patent term extension will extend the term of the application beyond the term of the application with the later priority date. Then, the obviousness-type double patenting rejection must be applied with due notice to the judicial framework imposed under pre-URAA law for an earlier filed application rejected for double patenting over a later filed patent/application. In particular, the existence of a patent term extension under 35 U.S.C. 154 indicates that a delay has already been caused by the Patent Office, as officially recognized by statute. Thus, unless the applicant could have filed the claims in the application with the earlier filing date, a two-way obviousness test must be used to determine whether or not an obviousness-type double patenting rejection is proper. The Examiner did not determine that a term extension would extend the term of the present application beyond the term of the later filed applications, and the Examiner did not use a two-way obviousness test. Thus, even assuming Arguendo that the Patent Office has authority to undermine the patent term extension provisions imposed by Congress, the rejection was not properly based on the presence of an appropriate patent term extension and on a two-way obviousness evaluation. Therefore, the rejection is improper and should be withdrawn.

In summary, the only possible rational to impose a double patenting rejection based on a later filed patent/application is the extension of the term of the first filed patent. However, the courts and the Patent Office do not have statutory authority to contravene the extension of patent term through requiring a Terminal Disclaimer. If the authority is present Arguendo, a two-way test should be used unless the later filed claims could have been filed in the earlier application. Even then, it is only proper if there is an actual patent term extension. In view of this, Applicants respectfully request withdrawal of the rejection based on obviousness-type double patenting of

claims 15, 23 and 25 over copending application 09/136,483 and claims 1-4, 6, 15 and 23-25 over copending application 09/433,202

B. REJECTIONS UNDER 35 U.S.C. § 102(b) OVER SHIMIZU

The Examiner rejected claims 26 and 29-31 as anticipated under 35 U.S.C. § 102(b) over U.S. Patent 4,842,837 to Shimizu et al. (Appendix B, the Shimizu patent). The Examiner notes that the Shimizu patent teaches polishing slurries. The Examiner asserts that the Shimizu patent teaches uniform silica particles having a single particle size 17, 25, or 42 nm, a purity greater than 99.9% and a single crystal phase. Applicants maintain that the Examiner has failed to establish prima faice anticipation of Applicants' claimed invention over the Shimizu patent. Applicants respectfully request reconsideration of the rejection based on the following analysis.

In the abstract and example 1, the Shimizu patent discloses that the particles are "highly monodispersed." The term "highly" is a relative term that does not quantify the degree of uniformity. In response to Applicants' arguments regarding the term "highly," the Examiner asserted that "examples 1, 3 and 4 and figure 1 show the particles have a single or uniform particle size." See Office Action of August 8, 2003 at page 5. Applicants assert that the magnification of figure 1 is insufficient to evaluate the presence of smaller particles. However, even the particles that are visible have noticeable size differences and some agglomeration. As a result, the Examiner has failed to produce a reference that contains every element as set forth in Applicants' claims. Certainly, the Shimizu patent does not disclose all of the features of Applicants' claimed invention in the detail claimed. Consequently, the Examiner has failed to establish prima facie anticipation since the Examiner has failed to establish that the reference teaches the claimed particle size distribution.

With respect to crystallinity as claimed in Applicants' claim 30, Applicants cannot even find a description in the Shimizu patent that the particles are cystalline. If the particles are

amorphous, they cannot fall within the conditions of claim 30. Thus, claim 30 is clearly not prima facie anticipated by the Shimizu patent.

Since the Shimizu patent does not prima facie anticipate Applicants' claimed invention, Applicants respectfully request the withdrawal of the rejection under 35 U.S.C. § 102(b) as being anticipated by the Shimizu patent.

C. REJECTIONS UNDER 35 U.S.C. § 102(b) OVER THE ROSTOKER '194 PATENT OR THE ROSTOKER '715 PATENT

The Examiner rejected claims 1, 2, 6, 7, 9, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 102(b) over U.S. Patent 5,389,194 to Rostoker et al. (Appendix C, the Rostoker '194 patent) or under 35 U.S.C. § 102(e) over U. S. Patent 5,626,715 to Rostoker (Appendix D, the Rostoker '715 patent). The relevant disclosure of these two patents is essentially identical. Thus, Applicants consider these two Rostoker patents together. The Examiner maintains that the Rostoker patents disclose all of the claim elements. Applicants maintain that the Rostoker patents do not teach all of the claim elements and that to the extent that the Rostoker patents do teach the claim elements, the Rostoker patents do not enable the practice of Applicants' claimed invention. Applicants respectfully request reconsideration of the rejections based on the following analysis.

There are two related but distinct issues. The first issue is whether or not the Rostoker patents discloses Applicants' claimed invention. Applicants have presented strong evidence that the Rostoker patents do not disclose Applicants' claimed invention to a person of ordinary skill in the art. Thus, there is no prima facie anticipation. Secondly, even if the Rostoker patents disclose Applicants' claimed invention, Applicants have presented clear evidence that the Rostoker patents do not enable the practice of Applicants' claimed invention. This second issue was primarily developed during prosecution of the parent application before the same Examiner. Applicants

believe that either of these issues are dispositive with respect to patentability of the present invention.

1. The Rostoker Patents Do Not Teach Applicants' Claimed Invention

As an initial evaluation of a reference, one must determine what the reference teaches. The Rostoker patents discuss the polishing process to a significant degree. Obtaining the materials for performing the polishing are discussed in detail in three paragraphs in column 5, lines 29-56 of the '715 patent and in column 6, lines 25-56 of the '194 patent. The first paragraph states as follows:

> Recently, methods have been developed for controllably producing ultrafine-grained, or nanocrystalline, materials (typically, about 1-100 nm grain diameters). These new methods have made possible the production of new materials having substantially different physical and chemical properties than the large grained, or single crystal, counterparts having substantially the same chemical composition.

The next paragraph discusses in detail the Siegel patent process and materials. The third paragraph of the triad states as follows:

> Given the recent advances in methods of producing such nanocrystalline materials, numerous problems in areas such as polishing semiconductor substrates can now be addressed using these new nanocrystalline materials.

It seems clear that the Rostoker patent is directed to polishing of substrates using the materials of the Siegel patent.

With respect to the polishing materials of Rostoker patent, these are described at column 7, lines 4-27 as follows:

> According to the invention, the alpha aluminum oxide particles used for polishing exhibit the following characteristics. Preferably, the particle size "X" nm, and the distribution of particle sizes is controlled to within "Y" nm, and the particles used for polishing are "Z" percent (%) in the alpha phase, where:
>
> "X" is 10-100 nm, such as 10, 20, 30, 40 or 50 nm, and is preferably no greater than 50 nm; and

> "Y" is approximately "P" percent of "X", where "P" is 10%, 20%, 30%, 40% or 50%, and is preferably no greater than 50% to ensure a narrow (Gaussian) distribution of particle sizes about "X";
> "Z" is at least 50%, including at least 60%, 70%, 80% and 90%, and as high as 100%.
> A quality factor "Q" is inversely related to "Y", and is a measure of the distribution of particle sizes. "Q" can be calculated as the concentration of particles at the desired size "X", divided by the range of sizes of particles at 3 db (decibles) lower than "X". Preferably, the size distribution of alpha aluminum oxide particles used for polishing exhibits a "Q" of at least 10, including 10, 50, 100, 500, 1000, 5000, or 10,000 ("Q" is dimensionless).

The meaning of this quoted language is in dispute, as described in detail below.

The Rostoker patents, relied upon by the Examiner, are far from clear with respect to their claims or the subject matter in their specification. The Rostoker patents describe particle collections with characteristics relating to the particle size distributions. But the descriptions of the particle size distributions is unintelligible. Appellants have long pointed to internal inconsistencies in the description. Nevertheless, the Examiner maintains that this gobbledygook teaches Appellants' claimed invention with the further support of prophetic examples, described below.

Applicants have previously submitted a declaration of Dr. Singh which presents a factual basis for concluding that the value of Q in the Rostoker patent cannot be determined. A copy of the Declaration is in Appendix E. The declaration clearly demonstrates that Dr. Singh is an **expert** in regards to particle technology. Furthermore, the declaration presents a detailed factual basis of why the value of Q cannot be determined.

In response to the Singh Declaration, the Examiner points to prophetic example 3 at column 8, line 65 to column 9, line 4 of the '715 patent and column 10, lines 5-11 of the '194 patent. Even within the Examiner's view, the use of +/- terminology at most interprets one parameter of the particle size distribution. Within this +/- notation, the spread generally is a confidence interval based on a particular probability level. (See, Appendix F, which are pages

from a Quantitative Analysis text). The probability level is not specified. Thus, the +/- terminology does not exclude a tail in the distribution contrary to the subject matter of Appellants' claim 15 or 26 or necessarily indicate a clear specification of uniformity as in Applicants' claim 1. Furthermore, this language must be interpreted in the context of the detailed description of the particle size distribution based on the quality factor Q. The Examiner has not explained how to reconcile these descriptions. The references must be considered as a whole. When viewing the references as a whole, they simply do not teach the uniformity of the particles as specified in Applicants' claimed invention.

In summary, the Examiner has failed to present prima facie evidence that the Rostoker patents teach the subject matter of Applicants' claimed invention. Specifically, the Rostoker patent does not teach subject matter that falls within the particle uniformity of Applicants' claimed invention. Furthermore, to the extent that the Rostoker patents do teach this subject matter, the Rostoker patents do not enable the practice of Applicants' claimed invention.

2. The Rostoker Patents Do Not Enable Applicants' Claimed Invention

Even assuming *arguendo* that the Rostoker patent can be interpreted to describe Appellants' claimed invention, clear and convincing evidence of record indicates that the Rostoker patent is not enabling with respect to Appellants' claimed invention. The Rostoker patent only teaches the methodology of the Siegel patent for teaching how to make nanoparticles. In an Amendment dated June 1, 1999, Applicants presented evidence in the parent case that the Siegel patent did not teach an approach suitable for forming Applicants' claimed invention. The Examiner acquiested that the Siegel patent was not enabling with respect to Applicants' claimed invention. See, office action of June 22, 1999, Appendix G. In response, the Examiner noted in the Office Action of June 22, 1999 that Applicants had not presented evidence that removing nanosized particles in a desired size range could not be separated out. In particular, the Examiner indicated that it may have been well known to a person of ordinary skill in the art how to form the

desired particle size distribution. Applicants then submitted information down loaded from the Millipore Corporation web site. Millipore is a leader in filtration technology.

In an Amendment dated August 11, 1999, Applicants presented evidence that filtration using commercially available filters for the filtration of particle slurries for chemical-mechanical polishing would not be effective to produce collections of particles with the narrow range of particle sizes claimed by Applicants. In response, the Examiner noted that the Rostoker patent did not need to establish what was already known in the art. The Examiner asserted that Applicants had not "presented any evidence methods of removing nanosized particles not in the desired size range were not well known to one of ordinary skill in the art at the time Rostoker was filed." The Examiner then asserted that Applicants must establish that "the method of the '081 patent was the only known method [sic] methods to provide for controlled production of nanocrystals known before 5 February 1993." Office Action of April 18, 2000, page 2, Appendix H.

Applicants then submitted a Declaration by an **expert** in the field, Professor Rajiv Singh. A copy of this Declaration can be found in Appendix I. Professor Rajiv Singh explicitly addressed the Examiner's concerns regarding particle separation technology available to a person of ordinary skill in the art. Professor Singh further concluded that "the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from about 5 nm to about 200 nm and a distribution of diameters such that at least about 95 percent of the particles have a diameter greater than about 60 percent of the average diameter and less than about 140 percent of the average diameter" and that "the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from about 5 nm to 200 nm and effectively no particles with a diameter greater than about 5 times the average diameter". This conclusion was based on Professor Singh's extensive experience in the surface polishing field. Note that Professor Singh was a Thrust Leader of Chemical Mechanical Planarization of the Engineering Research Center at the University of Florida.

Applicants note that the Rostoker patent is silent with respect to having to perform any size separation. Thus, the Rostoker patent provides no guidance for a person of skill in the art to obtain particle collections with narrow particle size distributions. As a result, the existence of methods, the types of methods and the application of the methods for appropriately size separating the particles all must have been well known in the art for the Rostoker patent to be enabling. **Applicants submit a Declaration by Professor Singh as evidence that such separation methods were not well known in the art at the filing date of the Rostoker patent or as of the filing date of Applicants' application.** In view of this evidence that no methods were known in the art for removing nanoparticles to produce a collection of particles with a narrow size distribution, Applicants have established that the Rostoker patent is not enabling with respect to the production of particle size distributions disclosed and claimed by Applicants. Applicants have already gone well beyond their burden in this case, in view of the overwhelming evidence presented by Applicants.

The Examiner made a clear error of law in evaluating Appellants' rebuttal evidence. In particular, Appellants clearly rebutted the enablement of the disclosure of the Rostoker patent with respect to the practice Appellants' claimed invention without undue experimentation. The Examiner inappropriately and contrary to law shifted the burden to Appellants to prove patentability rather than the failure of the Rostoker disclosure to enable the practice of Appellants' claimed invention.

The proposition is well established that the cited art only renders a composition of matter or apparatus unpatentable to the extent that the cited art enables the disputed claims or, in other words, if the cited art provides a means of obtaining the claimed composition or apparatus. Assertions in a prior art reference do not support an anticipation or obviousness rejection unless the references place the claimed invention in the hands of the public. The Rostoker patents clearly did not place Applicants' claimed invention in the hands of the public. The Examiner has clearly failed to establish otherwise by a preponderance of the evidence in view of Applicants' evidence.

Applicants maintain that the Examiner has failed to establish prima facie anticipation and rebutted prima facie anticipation to the extent that such a case was established. Specifically, Applicants maintain that the deficiencies of the Rostoker patents apply equally to the expression of the narrow distribution of particle sizes in claim 1 and claims depending from claim 1, as well as with respect to the particle size distributions lacking a tail in claim 15 and claims depending from claim 15. Claims 26, 27 and 29-31 relate to silicon compounds. The Rostoker patents indicate without any support whatsoever, the similar silicon oxide particles can be formed. Thus, enablement of the Rostoker patents with respect to silicon compounds is even much weaker that with respect to aluminum oxide.

Applicants respectfully request withdrawal of the rejections of claims 1,3, 6-8, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 102(e) over the Rostoker '715 patent and under 35 U.S.C. § 102(b) over the Rosotker '194 patent.

4. REJECTION UNDER 35 U.S.C. § 103(a) OVER SHIMIZU AND SECONDARY REFERENCES

The Examiner rejected claims 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over the Shimizu patent in view of U.S. Patent 5,318,927 to Sandhu et al. (Appendix J, the Sandhu patent), the Rostoker '715 patent and the Rostoker '194 patent. The Examiner specifically asserted that "Shimizu et al teach the claimed polishing compositions comprising a dispersion of silica particles." However, as discussed above, the Shimizu patent does not establish a prima facie case of anticipation of Applicants' claimed invention in independent claim 26 because it fails to disclose all of the claimed elements. More specifically, the Shimizu patent does not disclose particles with properties specified in Applicants' claims. The Examiner cited the Sandhu patent, the Rostoker '715 patent and the Rostoker '194 patent for their teaching of aqueous and nonaqueous solutions for polishing surfaces. The secondary references do not

make up for the deficiencies of the Shimizu patent with respect to independent claim 26 and thus with respect to dependent claims 27 and 28. Therefore, the combined disclosures of the cited references do not establish a prima facie case of obviousness of Applicants' claimed invention. Applicants respectfully request reconsideration of the rejection of claims 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over the Shimizu patent in view of the Sandhu patent, the Rostoker '194 patent and the Rostoker '715 patent.

E. REJECTION UNDER 35 U.S.C. § 103(a) OVER ROSTOKER OR ROSTOKER ET AL.

The Examiner rejected claims 1, 2, 6-9, 12, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over either the Rostoker '194 patent or the Rostoker '715 patent. The Examiner asserted that "both of these references teach a method of polishing a semiconductor surface using a polishing composition composed of particles dispersed in an aqueous solution where the polishing is performed using a polishing pad." However, the Rostoker '194 patent and the Rostoker '715 patent, taken alone or together, do not establish a prima facie case of obviousness because they do not teach or suggest particles with the properties specified in Applicants' claims. The deficiencies of the Rostoker patents are described in detail above. The arguments apply with equal force to the obviousness issues in addition to the anticipation issues. Applicants respectfully the withdrawal of the rejection of claims 1, 2, 6-9, 12, 15, 23, 25-27 and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over the Rostoker '194 patent or the Rostoker '715 patent.

F. REJECTION UNDER 35 U.S.C. § 103(a) OVER SANDHU ET AL., ROSTOKER ET AL. AND ROSTOKER

The Examiner rejected claims 1-3, 6, 15 and 23-31 under 35 U.S.C. § 103(a) as being unpatentable over the Sandhu patent in view of the Rostoker '715 patent or the Rostoker '194 patent. The Examiner asserted that the Sandhu patent "teach[s] a method of smoothing a surface using a chemical-mechanic polishing composition comprising alumina or silica abrasive particles dispersed in either an aqueous or a nonaqueous solution." The Examiner cited the secondary references for disclosing conventional chemical mechanical polishing. The Examiner admitted that the Sandhu patent does not "teach the particle size characteristics for the taught abrasive particles." The Examiner then asserts that the Rostoker patent teach "chemical mechanical abrasive particles."

The extreme deficiencies of the Rostoker patents are described above. Since the Examiner is relying on the Rostoker patents to support this rejection, prima faice obviousness has clearly not been established. Applicants maintain that the deficiencies of the Rostoker patents applies equally to the narrow particle size distributions in claim 1 and claims depending from claim 1 as well as the particle distributions that lack a tail in claim 15 and claims depending from 15. The deficiencies of the Rostoker patent are particularly pronounces with respect to the silicon compounds claims in Applicants' claims 26, 27 and 29-31 since the Rostoker patent gives no information on how to obtain these particles.

Applicants respectfully request the withdrawal of the rejection of claims 1-3, 6, 15 and 23-31 under 35 U.S.C. § 103(a) as being unpatentble over the Sandhu patent in view of the Gutsche patent, the Rostoker '194 patent and the Rostoker '715 patent.

CONCLUSIONS AND REQUEST FOR RELIEF

Applicants submit that claims 1-4, 6-10, 12-15 and 23-31 are free of the cited references. Thus, Applicants respectfully request the reversal of the rejections of claims, and the allowance of claims 1-4, 6-10, 12-15 and 23-31.

Respectfully submitted,

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February 10, 2004
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Peter S. Dardi, Ph.D.

APPENDIX A

PENDING CLAIMS

1. A polishing composition comprising a dispersion of particles, the particles comprising a non-silicon metal compound and having an average particle diameter from about 5 nm to about 50 nm and a distribution of diameters such that at least about 95 percent of the particles have a diameter greater than about 60 percent of the average diameter and less than about 140 percent of the average diameter.

2. The polishing composition of claim 1 wherein the particles are dispersed in an aqueous solution.

3. The polishing composition of claim 1 wherein the particles are dispersed in a nonaqueous solution.

4. The polishing composition of claim 1 wherein the non-silicon metal compound is selected from the group consisting of TiO_2, Fe_3C, Fe_7C_3, Fe_2O_3, Fe_3O_4, MoS_2, MoO_2, WC, WO_3 and WS_2.

6. A method of smoothing a surface comprising the step of polishing the surface with the polishing composition of claim 1.

7. The method of claim 6 wherein the polishing is performed with a polishing pad.

8. The method of claim 6 wherein the polishing is performed with a motorized polisher.

9. The polishing composition of claim 1 having a single crystalline phase with a uniformity of at least about 90 percent by weight.

10. The polishing composition of claim 9 wherein the non-silicon metal compound is selected from the group consisting of TiO_2, Fe_3C, Fe_7C_3, Fe_2O_3, Fe_3O_4, MoS_2, MoO_2, WC, WO_3 and WS_2.

12. The polishing composition of claim 9 wherein the particles have a single crystalline phase with a uniformity of at least about 95 percent by weight.

13. The polishing composition of claim 9 wherein the particles have a single crystalline phase with a purity of at least about 99 percent by weight.

14. The polishing composition of claim 9 wherein the particles have a single crystalline phase with a purity of at least about 99.9 percent by weight.

15. A polishing composition comprising a dispersion of particles, the particles comprising a non-silicon metal compound with an average particle diameter from about 5 nm to about 50 nm, wherein less than about 1 particle in 10^6 has a diameter greater than about five times the average diameter.

23. The polishing composition of claim 15 wherein the particles are dispersed in an aqueous solution.

24. The polishing composition of claim 15 wherein the particles are dispersed in a nonaqueous solution.

25. A method of smoothing a surface comprising polishing the surface with the polishing composition of claim 15.

26. A polishing composition comprising a dispersion of particles, the particles comprising a silicon compound with an average particle diameter from about 5 nm to about 45 nm, wherein less than about 1 particle in 10^6 has a diameter greater than about five times the average diameter.

27. The polishing composition of claim 26 wherein the particles are dispersed in an aqueous solution.

28. The polishing composition of claim 26 wherein the particles are dispersed in a nonaqueous solution.

29. The polishing composition of claim 26 wherein the silicon compound is selected from the group consisting of SiO_2 and SiC.

30. The polishing composition of claim 26 having a single crystalline phase with a uniformity of at least about 90 percent by weight.

31. A method of smoothing a surface comprising the step of polishing the surface with the polishing composition of claim 26.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Kumar et al.	
Applic No.: 09/085,514	
Filed : May 27, 1998	Group Art Unit: 1773
For : SILICON OXIDE PARTICLES	Examiner: K. Bernatz
Docket No.: 2950.02US01	

DECLARATION UNDER 37 C.F.R. § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

I HEREBY CERTIFY THAT THIS PAPER IS BEING SENT BY U.S. MAIL, FIRST CLASS, TO THE ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231, THIS

___ DAY OF _____, 20___.

_____
PATENT ATTORNEY

Sir:

I, Rajiv K. Singh, Ph.D., hereby declare as follows:

1. I am presently a Professor of Material Science and Engineering at the University of Florida at Gainesville. Apart from my academic responsibilities, I provide consulting services through R. K. Singh Consulting Inc.

2. I received my Ph.D. degree in 1989 in Material Science and Engineering from North Carolina State University, Raleigh, NC.

3. I have been on the faculty at the University of Florida since 1990. I was promoted to Associate Professor with tenure in 1995 and to full Professor in 1997. A copy of my Curriculum Vitae is attached.

4. My recent accomplishments include receiving a National Science Foundation Young Investigator Award in 1994 and the Hardy Gold Metal for Outstanding Contributions in Material Science in

1995. I was a Distinguished Visiting Professor/Scientist at National University of Singapore (1999) and National Institute for Materials and Chemical Research, Tsukuba, Japan (2000). I am a fellow of the American Society for Materials (ASM). I am the author or co-author of more than 300 scientific articles and conference proceedings. I have co-edited seven books and guest edited five journal issues.

5. I have organized over 15 international conferences in advanced processing of materials including nano-particle science and technology and chemical- mechanical polishing (CMP).

6. I have been the Associate Director of the Engineering Research Center for Particle Science and Technology, at the University of Florida from 1994 -2001. My prime responsibility at this position was to develop advanced techniques for characterization of particles.

7. I am under a Consulting Agreement with NanoGram Corporation to provide consulting services in the area of chemical-mechanical planarization. I am not a shareholder in NanoGram Corporation. Also, I have no interest in the present patent application.

8. I have been working in the area of surface polishing and material science relating to properties of inorganic particles for many years. My laboratory at the University of Florida has performed extensive experiments in particle properties and in surface polishing.

9. I have read carefully U.S. Patent 5,128,081 to Rostoker, U.S. Patent 5,128,281 to Siegel et al., U.S. Patent 5,846,310 to Noguchi et al., U.S. Patent 4,775,520 to Unger et

al., and a passage from Ullmann's Encyclopedia of Industrial Chemistry, Vol. A23 at pp. 635-639. In addition, I have read the pending claims of the above noted patent application entitled "SILICON OXIDE PARTICLES." I did not participate in any capacity with the preparation of the SILICON OXIDE PARTICLES patent application.

10. With respect to the Rostoker '081 patent, a theoretical type of distribution is described in the patent. This distribution as described by Rostoker has several internal inconsistencies, as described below. Additionally, this distribution described by Rostoker does not conform to any standard representation of distribution functions described in standard textbooks and standard references.

In the Rostoker distribution, X is the average particle size. Y relates to a range around X. However, Q is important since Q, in principle, defines the size distribution. Unfortunately, the discussion of Q is not internally consistent. Q is indicated in the patent to be a dimensionless quantity. Q is defined as the concentration of particles at "X" divided by a concentration of particles in a range 3dB lower than "X". The numerator of this expression has units of $\#/cm^3$, whereas the denominator term denoted by concentration of particles in a range of sizes 3dB below X has units of $\#/cm^2$. Thus, according to Rostoker's definition, Q is not dimensionless but has units of 1/cm or 1/length. For Q to be a dimensionless quantity, either both the quantities should be defined in a certain range (e.g., concentration range +1dB of X divided by concentration at range +1dB at X/2), or both the quantities should describe the concentration at specific values (e.g., at X and at 3dB below X).

Even if we assume that the patent described Q as ratios at concentrations at X and at 3dB below X (which is not the case

in the patent description), which makes Q dimensionless, there are several more inconsistencies. First, the particle size distribution is defined by only two points, which can be extrapolated into any distribution one might choose to elect. Secondly, if we define A as the point at which the concentration of particles in a range 3bd below x, then the concentration at A equals concentration at $X/10^{0.3}$. Then the concentration at A corresponds approximately to the concentration at X divided by 2. This value does not correspond to a Gaussian distribution, and the evaluation of A does not address the problems with the definition of Q. The Rostoker patent nowhere describes a 3 sigma (standard deviation) distribution. Also, the standard deviation cannot be defined for a distribution given in the patent.

It should be noted that the particle size distribution, as described in the Rostoker patent is not consistent with the particle size distributions that are frequently used in the standard particle size and technology books and publications. Examples of some of the standard book publications with which I am familiar are 1) A. Jillaventesa, S. Dapkunas and L.H. Lum, "Particle Size Characterization," NIST Recommended Practice Guide, NIST Special Publication, 960-1 (2001); 2) T. Allen, "Particle Size Measurement," 4th Edition, Chapman and Hall, London (1992); 3) B. H. Kaye and R. Trottier, Chemical Engineering, 99:84 (April 1995); 4) R. J. Hunter, "Foundations of Colloidal Science," Wiley (1998); 5) E. Kissa, "Dispersions, Characterization Testing and Measurement," and 6) B. V. Miller and R. Lines, CRC Critical Reviews in Analytical Chemistry, 20:75-116 (1988). Relevant pages from Reference 4 are attached.

The only source of powders described in the Rostoker '081 patent is the process described in the Siegel patent. However, the Siegel patent only describes the formation of nanocrystalline materials. In other words, the materials are polycrystalline materials with nanocrystalline domains. The

Siegel patent does NOT describe the formation of submicron particles. Furthermore, I am aware of no approaches for the formation of silica particles as claimed by NanoGram except for the NanoGram process, as described further below.

11. With respect to the Unger '520 patent, this patent describes the formation of a silica gel using a two-step process. I have considerable experience with reactions that form silica gels including the Stober process and processes similar to the Unger process, from work that has been performed in my lab in Gainesville. Also, the process that leads to the formation of silica particles from alkoxide precursors is well documented in the literature, such as the texts Sol Gel Science, by C. Jeffrey Brinker and G. Scherer, Academic Press (1990) and The Chemistry of Silica, by R. K. Iler, Wiley (1979). The first step in the Unger process uses the Stober process to form a silica gel.

In the second step, increasing the particle size and removal of the porosity further refines the sol. In both the Stober and Unger processes, the hydrolysis of the alkoxide precursors occurs in basic conditions leading to formation of sol as a result of hydrolysis, polymerization and condensation reactions. The sol particle in this process typically consists of partially coalesced small clusters that form porous structures. The clusters typically are made of trimers and tetramers of silicon-hydrogen-oxygen precursors such as $SiO(OH)_3$, $SiO_2(OH)_2$, $Si_4O_6(OH)_6$, $Si_4O_8(OH)_4$, etc. After the condensation process, the clusters contain a large number of silanol groups and siloxane bonds. Several workers have made extensive studies on the use of FTIR, NMR and Raman Spectroscopy to understand the formation of the particles. Articles by Lippert et al. and Zerda et. al. are attached.

The cluster-like aggregates making the sol particles are typically smaller than 50 nm, and have a high surface area due to formation of the porous structures. Because of the high

porosity the surface area of the sols are much larger than the theoretical calculated surface area. The Unger patent also shows that the surface area of the sols of 100 - 350 m^2/gm, which is typically nearly two orders of magnitude greater the theoretically calculated surface areas based on the size of the particle measured by standard techniques such as TEM, and light diffraction measurements. Thus the sols are chemically and structurally different from a non-porous silica particle which is typically obtained from the Nanogram process. Specifically, the sols may have significant chemical variation than silicon dioxides, and the aggregates do not have the uniformity described in the NanoGram claims.

12. With respect to the Noguchi patent, this patent describes the application of a coating onto the silica gel of the Unger patent. The Noguchi patent does not deal with the synthesis of silica particles.

13. Pyrolytic or flame produced process is a standard method to make small particles of silica, alumina, titania, etc. There are several references that show the details on the flame-produced process. Examples include 1) Ulmann's encyclopedia; 2) Ulrich, Combustion Science Tech. 4:47-57 (1971); 3) G. W. Scherer in Better Ceramics Through Chemistry, eds. C. J. Brinker et al. (North Holland, NY 1984); 4) D. W. Schaefer, Material Research Society Bulletin, 13:22-27 (1988); 5) J.E. Martin et al., Phys. Rev. A 33:3540-3543 (1986); 6) A. J. Hurd et al., Phys. Rev. A 35:2361-2364 (1987); 7) J. D. F. Ramsay, Colloidal Surfaces 18:207-221 (1986). Copies of References 2, 5 and 6 are attached for reference. In the flame oxidation process, the small particles, which are formed by the oxidation reaction initially aggregate with each other by a ballistic process which mean that the mean free path of the aggregating species is large, compared

to the cluster size. In the second phase of the growth process, once the particles are large compared to the mean free path the trajectories of the particles change from ballistic to Brownian motion. The meandering path of the Brownian motion encourages attachment of the incoming cluster to the target periphery reacting aggregates and ramified fractal structures. Standard techniques such as visible light scattering and small angle neutron scattering have been used to show that the fractal dimension of the particles is characteristic of the diffusion limited cluster aggregation. Depending on the residence time and reactor design, the size of the primary particles may vary from 20 nm to 200 nm.

Although the primary particle size of the pyrolytic silica can be small, the particles form hard aggregates that neck in the aggregates, which make them difficult to disperse. The neck formation has been determined from transmission electron micrography (TEM). Attempts to disperse these particles result in dispersion of clusters of the fused aggregates forming individual particles. There is no way to separate the fused aggregates because the fusing results in hard bonding. Workers in field unfortunately refer to the grains that are fused together as primary particles, even though the hard fusing of these grains prevents separation of the grains as distinct particles. The actual particles are the fused entities or cluster rather than the individual 'grains'. Thus, the particles are very non-uniform even if they are formed from fused grains that may be relatively uniform.

As further support for observations from my direct experience, I have attached a TEM micrograph from my lab that provide documentary evidence of these materials formed by the process described in Ullmann's Encyclopedia. The particle have an average particle size of about 20 - 50 nm and cluster sizes on average of about 250 nm. Due to the hard fusing of these

particles, the aggregates do not have high uniformity.

14. In my experiences, I have not seen materials comparable to the materials claimed in the NanoGram patent application. Based on my extensive experience with surface polishing, I expect that the NanoGram materials will be very good materials for surface polishing since the performance is expected to depend on the uniformity of the polishing materials. Thus, the NanoGram silica particles fill a void in the types of materials available for surface polishing. While NanoGram has not commercially exploited their silica materials for surface polishing yet due to their efforts with other commercial activities, I expect that these materials will someday have a significant commercial role in improving surface polishing of substrates.

14. I declare that all statements made herein that are of my own knowledge are true and that all statements that are made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: Dec. 10' 01 By: Rajiv K. Singh

Rajiv K. Singh, Ph.D.

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"Express Mail" mailing label number EV 011652515 US. Date of Deposit: December 12, 2001. I hereby certify that this paper is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Box AF, Washington, DC 20231.

Glenda Anderson
Name of Person Making Deposit

Glenda Anderson
Signature

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Materials Science and Engineering
University of Florida
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Research Interests:

Innovative processing of materials; Laser processing; thin films; transient thermal phenomena; superconducting and dielectric(low K and high K) thin films; diamond and related materials, rapid thermal processing of elemental and wide band gap semiconductors, chemical-mechanical planarization, particulate coatings;semiconductor processing; modeling of transient thermal processing; flat panel displays, Angstrom scale advanced materials characterization, oxide thin films & electronics, gallium nitride and diamond crystal growth, nanoparticle synthesis and processing, front and back end semiconductor cleaning, phosphors and flat panel displays, thin film batteries.

Education

Ph.D. Materials Science and Engineering, North Carolina State University, Raleigh, 1989
M.S. Materials Science and Engineering, North Carolina State University, Raleigh, 1987
B.S. Chemical Engineering, Jadavpur University, Calcutta, India, 1985

Positions Held

97-pre ***Professor***, Materials Science and Engr., University of Florida
94-pre ***Director***, Characterization Research Instrumentation and Testbed (CRIT) Facility, Engineering Research Center (ERC), University of Florida
96-pre***Thrust Leader***, Chemical Mechanical Planarization (CMP), ERC Univ of Florida
94-pre***Thrust Leader***, Engineered Particulates, ERC, Univ. Florida
95-97 **Associate Professor**, Materials Science and Engr., University of Florida
90- 94 ***Assistant Professor***, University of Florida, Gainesville, FL

Awards/Honors

2000 - ***Distinguished Visiting Scientist,*** NIRIM, Tsukuba, Japan
1999 ***Distinguished Visiting Professor***, National University of Singapore, Singapore
1998 ***Distinguished Visiting Professor***, University of Osaka, Osaka, Japan
1995 ***Hardy Gold Medal*** from TMS/AIME for Outstanding Contributions in Materials Science
1994 ***NSF Young Investigator Award***
94-97 ***Visiting Fellow***, Center for Ultrafast Optical Science (CUOS), University of Michigan
1993 ***IEEE Senior Member*** Award
1991 ***IBM Faculty Development*** Award
1989 ***MRS Best Graduate Student*** Award
1985 ***Alumni Gold Medal*** for Best Overall Graduating Senior from the University
1985 ***Laha Silver Medal*** for Best Graduate from College of Engineering

Publications:

Over 293 papers (> 268 published/in print & 25 submitted for various materials science and engineering journals (*Science, Physical Review B,, Applied Physics Letters, Journal of Materials Research, Materials Science and Engineering B, etc.*) and Conference Proceedings. Published over 32

original, *principal author papers in* App. Phy. Lett. (The most cited electronic materials/applied physics based journal), and 7 papers published in Physical Review B

Invited and Contributed Talks

Presented more than **110** invited talks at international conferences (MRS, SPIE, TMS, APS, ASME, etc.) and academic and research institutions (MIT, Columbia, Purdue, ORNL, Westinghouse, etc.). Also group presented over **250** technical papers at international conferences

Books and Guest Editorships (Edited 5 books & Guest Editor of 5 Journal Issues)

(1) R. K. Singh, D. Norton, J Cheung and J. Narayan and L.D. Laude , *Eds "Laser Processing of Materials: Fundamentals and Advanced Applications*, MRS Proceedings Vol 397, Pittsburgh, PA, 1996

(2). N. M. Ravindra and R.K. Singh,"*Transient Thermal Processing of Materials*", TMS, Warrendale April. 1996

(3). K. Gonsalves, M. Baraton, J.. Chen, J. Akkara, R. K. Singh and H. Hofmann , "*Surface Controlled Nanoscale and Microscale Materials for High Value Added Applications*, MRS Proceedings Vol 501 , Pittsburgh, PA, March 1998

(4). R.K. Singh, D. Lowdnes, J. Narayan, D. Chrisey , T. Kawai, and E. Fogarassy, Editors, *Advances in Laser Ablation of Materials*", MRS Proceedings for Spring 1998 .

(5). R. K. Singh and D. Kumar, "*Advances in Pulsed Laser Deposition of Thin Films*", Kluwer publishers, (1998)

(1)*Guest Editor* of September 1994, Vol 23 issue of *Journal of Electronic Materials* titled " *Novel Issues in Photonic Materials*"

(2) *Guest Editor* of Jan,96, Vol 1 issue of *Journal of Electronic Materials* titled *"Ion and Laser Beam Processing of Electronic Materials"*

(3) Guest Editor of Materials Science and Engr. B, on *Laser Processing of Electronic Materials*, Jan 1997

(4) *Guest Editor* of November 1997 Issue of *Journal of Electronic Materials* on *"Low Energy Beam Processing of materials."*

(5)*Guest Editor* of September 1998 Issue of *Journal of Electronic Materials* on *"Chemical-Mechanical Polishing of Semiconductors.*

Teaching Accomplishments

Developed four new courses:"Beam-Solid Interactions", "Thin Films" & "Math. Methods", "Survey of Materials Analysis" in the graduate MS&E program

Graduated 12 Master's and 10 Ph.D Students; Presently thesis advisor to 9 Ph. D Students

8 students awarded best paper/fellowships for their undergraduate/graduate research projects.

Developing CD-ROM materials and multi-media classroom for the NSF ERC project.

Established ParTiN (Particle technology) Hypertext Network for educational &ERC programs on the WWW (World Wide Web)

Corporate Interactions

Direct Research Interactions with several companies including IBM, Intel, Motorola, Ashland Chemical, Westinghouse, Lucent Technology, Applied Materials, Sony, Glaxo Wellcome, Lockheed Martin, Astra Zeneca, Purdue Pharma

Licensing Discussions with Sony, Nara Machinery, Astra Zeneca, Glaxo, etc.

Corporate funding over 200 K/yr .

Copyrighted Softwares (3 copyrighted softwares) including

(A) **SLIM** (*Simulation of Laser Interaction with Materials*, 36,000 coded lines, 1992) software. This first of its kind software is being used by more than 50 R&D groups (IBM, LANL, ORNL, etc.) in the world. This software calculates the transient thermal induced laser effects like melting, crystallization and ablation of materials. This software has had sales greater than $ 60 K worldwide in the last four years. Two new versions (one based on DOS C^{++} and the other on Windows platform) have been developed..

Patents (from a total of 30 disclosures:[**14** patents, 10 awarded/pending(final stage) and 4 filed])

(1) ***High Surface Area Metals and Ceramics*** [US Patent 5,473,138] . A unique laser technique has been developed to increase the surface areas of ceramics, metals and composites. This technique involves the use of multiple-pulse laser irradiation under controlled energy window conditions.

(2) ***Enhanced Chemical Vapor Deposition of Diamond*** [US Patent 5,485,804 {1996}, Filed for worldwide patent} Novel colloidal method for large area nucleation, of diamond. *This method has been used to make the world's largest single monolithic piece of diamond which has a diameter greater than 11" and weighs over 1600 carats.*

Conference Chairs [Organized **16 international** conferences on innovative processing and characterization of materials]

(1) Chair of Symposium. on "Beam Processing of Materials", ***TMS/AIME Winter meeting***, Chicago Nov 92;

(2)Co-Chairman of Symposium on "Innovative Processing of Electronic and Photonic Materials" ***TMS/AIME Annual Meeting***, Denver, Feb 1993;

(3) Chairman of Conference on "Advanced Laser Processing of Materials" ***Engineering Foundation*** Conf., Palm Coast, FL, May 1-6 1994:

(4)Chair of Symposium on " Ion Beam Processing of Materials" ***TMS Spring Meeting***, LasVegas, Feb 1995

(5) Co-Chair of symposium on "Laser Processing of Materials" ***American Physical Society***, San Diego, March 1995

(6) Chair of Symposium on " Advanced Laser Processing of Materials: Fundamentals and Advanced Applications" **MRS Meeting**, Boston Nov 1995

(7) Co-Chair, Symposia on "Transient Thermal Processing of Materials", **TMS Annual Meeting**,Anaheim, CA Feb, 1996

(8)Chairman of symposium on, " Low Energy Beam Processes", **TMS Annual Meeting**, Orlando , FL Feb, 1997

(9)Chairman of symposium on " Particulate Coatings", **MRS Fall Meeting**, Boston November, 1997

(10) Co-Chairman of " Laser and Ion Beam Processing of Materials", **International Union of Materials Research Societies (IUMRS)**, Chiba, Japan, September 1997

(11) Co-Chairman," Transient Thermal Processing of Materials , **TMS Annual Meeting**, San Antonio, Feb 1998

(12) Co-Chairman," Chemical Mechanical Planarization of Materials Symposia, **TMS Annual Meeting**, San Antonio, Feb 1998

(13) Chairman, " Advances in Pulsed Laser Ablation of Materials", **MRS Spring Meeting**, San Francisco, April, 1998

(14) Co-Chairman, " Particulate Coatings" **5th World Congress on Particle Science and Technology**, Brighton UK, July 1998

(15) Co-Chairman " Rapid Thermal Processing of Materials"- **European MRS Meeting,** Strasbourg, June, 1998

(16) Chairman, "Chemical Mechanical Polishing Symposia", ***MRS Spring Meeting***, San Francisco, April 2000

Invited Review Articles

1 "*Pulsed Laser Deposition of Thin Films*", *Materials Science and Reports*" in March, (1998)

2. "SLIM,. A Personal Computer Based Simulation of Laser Interaction With Materials", *J Journal of Materials*, 44, 20 (1992)

3. " Pulsed Laser Deposition and Processing of Superconducting Thin Films", *J. of Materials* 43, 13 (1991)

Book Chapters

1. D. Gilbert and R. K. Singh, " Boron Nitride Interfaces", in " *Properties of Group III Nitrides*, Edited by James Edgar, *Imspec* publication, London 1995 2. R. K. Singh, " Raman Based Optical Properties of YBaCuO Surfaces", in " *Optical Properties of Materials*", Eds R. Hummel, CRC Press, 1996

3. R.K. Singh and D. Kumar, "Pulsed Laser Deposition of Superconducting Thin Films", *Materials Science and Engr. Reports* (in press, 1996)

4. R. K. Singh and D. Kumar, " Thermal Annealing of Semiconductors", *Encyclopedia of Applied Physics*, VCH Publishers (1996)

5. D. Gilbert and R. K. Singh, " Diamond Deposition for Electronic Applications", Eds . S. Pearton on *Wide Band Gap Semiconductors*", VCH Publishers 1997

)

Reviews

Reviewer for NSF, DOE, Physical Review B, Materials Science and Engineering, Journal of Applied Physics, Applied Physics Letter, Journal of Materials Research and Physica C. Invited to serve as panel members for several NSF initiatives

Memberships and Committee Chairmanships:

Member of MRS, ASM, TMS, IEEE (senior member), APS, AICHE, SPIE

Chairman: Thin Films and Interfaces Committee , TMS (1993 -1996)

Member: Laser Processing of Materials Committee, CLEO

Institutional Impact

(A) Helped establish the 60 million, NSF Funded ***Engineering Research Center (ERC)*** on particle science and technology at the University of Florida:

(B) Leader of team for the NSF MRSEC Proposal submitted in 1995 & 1997

(C)Established cross-disciplinary multi P.I programs in Rapid Thermal Processing, Particle Coating Technology, Radiation Damage in Electronic Devices, and Beam Processing of Materials:

(D) Established industrial and scientific collaborations with various institutions:

(E) Established international collaborations with

(i) CNRS, Strasbourg France, (ii) University of Melbourne, Australia, (iii) University of Osaka, Japan, (iv) Keio University, Japan, (v) EPFL, Lausanne, Switzerland, (vi) Unicamp, Sao Paulo Brazil, (vii) National University, Singapore

3rd EDITION

QUANTITATIVE ANALYSIS

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Emory University

A. L. Underwood
Emory University

Prentice-Hall, Inc., Englewood Cliffs, New Jersey

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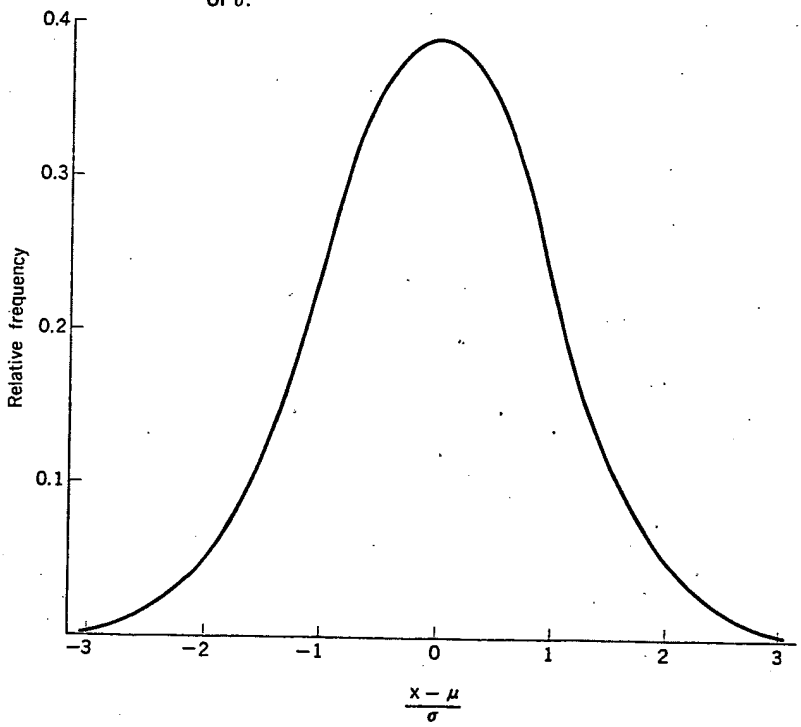
The Normal Error Curve

The limiting case approached by the frequency polygon as more and more replicate measurements are performed is the *normal* or *Gaussian* distribution curve, shown in Fig. 3.2. This curve is the locus of a mathematical function which is well-known, and it is more easily handled than the less ideal and more irregular curves that are often obtained with a smaller number of observations. Data are often treated as though they were normally distributed in order to simplify their analysis, and we may look upon the normal error curve as a model which is approximated more or less closely by real data. It is supposed that there exists a "universe" of data made up of an infinite number of individual measurements, and it is actually this "infinite population" to which the normal error function pertains. A finite number of replicate measurements is considered by statisticians to be a sample drawn in a random fashion from a hypothetical infinite population; thus the sample is at least hopefully a representative one, and fluctuations in its individual values may be considered to be normally distributed, so that the terminology and techniques associated with the normal error function may be employed in their analysis.

FIGURE 3.2 Normal distribution curve; relative frequencies of deviations from the mean for a normally-distributed infinite population; deviations $(x - \mu)$ are in units of σ.



The equation of the normal error curve may be written for our purposes as follows:

$$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/2\sigma^2}$$

Here y represents the relative frequency with which random sampling of the infinite population will bring to hand a particular value x. The quantities μ and σ, called the population parameters, specify the distribution. μ is the *mean* of the infinite population, and since we are not here concerned with determinate errors, we may consider that μ gives the correct magnitude of the measured quantity. It is clearly impractical to determine μ by actually averaging an infinite number of measured values, but we shall see below that a statement can be made from a finite series of measurements regarding the probability that μ lies within a certain interval. To the extent of our confidence in having eliminated determinate errors, such a statement approaches an assessment of the true value of the measured quantity. σ, which is called the *standard deviation*, is the distance from the mean to either of the two inflection points of the distribution curve, and may be thought of as a measure of the spread or scatter of the values making up the population; σ thus relates to precision. π has its usual significance and e is the base of the natural logarithm system. The term $(x - \mu)$ represents simply the extent to which an individual value x deviates from the mean.

The distribution function may be normalized by setting the area under the curve equal to unity, representing a total probability of one for the whole population. Since the curve approaches the abscissa asymptotically on either side of the mean, there is a small but finite probability of encountering enormous deviations from the mean. A person who happened to encounter one of these in performing a series of laboratory observations would be unfortunate indeed; some of us who have faith in never obtaining such a "wild" result in our own work are inclined to the view that the normal distribution as a model for real data breaks down, and that only the central region of the distribution curve is pertinent when applied to scientific measurements by competent workers. The area under the curve between any two values of $(x - \mu)$ gives the fraction of the total population having magnitudes between these two values. It may be shown that about two-thirds (actually 68.26%) of all the values in an infinite population fall within the limits $\mu \pm \sigma$, while $\mu \pm 2\sigma$ includes about 95% and $\mu \pm 3\sigma$ practically all (99.74%) of the values. Happily, then, small errors are more probable than large ones. Since the normal curve is symmetrical, high and low results are equally probable once determinate errors have been dismissed.

When a worker goes into the laboratory and measures something, we suppose that his result is one of an infinite population of such values that he might obtain in an eternity of such activity; then the chances are roughly 2 to 1 that his measured values will be no further than σ from the mean of the infinite population, and about 20 to 1 that his result will lie in the range

$\mu \pm 2\sigma$. In practice, of course, we can never find σ for an infinite population, but the standard deviation of a finite number of observations may be taken as an estimate of σ. Thus we may predict something about the likelihood of occurrence of an error of a certain magnitude in the work of a particular individual once he has performed enough measurements to permit estimation of the characteristics of his particular infinite population.

STATISTICAL TREATMENT OF FINITE SAMPLES

Although there is no doubt as to its mathematical meaning, the normal distribution of an infinite population is a fiction so far as real laboratory work is concerned. We must now turn our attention to techniques for handling scientific data as we obtain them in practice.

Measures of Central Tendency and Variability

The *central tendency* of a group of results is simply that value about which the individual results tend to "cluster." For an infinite population, it is μ, the mean of such a sample. The *mean* of a finite number of measurements, $x_1, x_2, x_3, \ldots, x_n$, is often designated $\bar{x}$ to distinguish it from μ. Of course $\bar{x}$ approaches μ as a limit when n, the number of measured values, approaches infinity. Calculation of the mean involves simply averaging the individual results:

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \cdots + x_n}{n} = \frac{\sum_{i=1}^{i=n} x_i}{n}$$

The mean is generally the most useful measure of central tendency. It may be shown that the mean of n results is $\sqrt{n}$ times as reliable as any one of the individual results. Thus there is a diminishing return from accumulating more and more replicate measurements: The mean of four results is twice as reliable as one result in measuring central tendency; the mean of nine results is three times as reliable; the mean of twenty-five results, five times as reliable, etc. Thus, generally speaking, it is inefficient for a careful worker who gets good precision to repeat a measurement more than a few times. Of course the need for increased reliability, and the price to be paid for it, must be decided on the basis of the importance of the results and the use to which they are to be put.

The *median* of an odd number of results is simply the middle value when the results are listed in order; for an even number of results, the median is the average of the two middle ones. In a truly symmetrical distribution, the mean and the median are identical. Generally speaking, the median is a less efficient measure of central tendency than is the mean, but in certain instances it may be useful, particularly in dealing with very small samples.

Since two parameters, μ and σ, are required to specify a frequency distribution, it is clear that two populations may have the same central tendency

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IM62/0622

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ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

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CHECKED BY ATTY	12-22	-99

Office Action Summary	Application No. 08/961,735	Applicant(s) Kambe et al
	Examiner Melissa Koslow	Group Art Unit 1755

☒ Responsive to communication(s) filed on *3 Jun 1999*.

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *three* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-16 and 23-26* is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☒ Claim(s) *16, 25, 26* is/are allowed.

☒ Claim(s) *1-15, 23 and 24* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *10*

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

This action is in response to applicants' amendment of 3 June 1999. The objections to the drawings and the specification are withdrawn. The art rejections over Fiato and Majetich et al are withdrawn in view of the amendments to the claims. Applicant's arguments with respect to the remaining rejections have been fully considered but they are not persuasive.

The attempt to incorporate subject matter into this application by reference to the article by Bi et al discussed on page 8 is improper because it is a publication and the incorporated subject matter appears to be essential.

The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper. Applicant is required to amend the disclosure to include the material incorporated by reference. Or to indicate the material be incorporated is not essential. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or a practitioner representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973).

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 2 and 4-15, 23 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Rostoker.

This reference teaches a polishing composition comprising a dispersion of alumina or silica particles. The taught particles have an average diameter of 10-100 nm and a distribution where preferably 100% of the particles have a diameter within 50% of the average particle diameter, preferably 40% of the average diameter. This means the distribution of diameters such that 100% have a diameter greater than 40% of the average diameter and less than 140% of the average diameter. It is clear none of the taught particles have a diameter greater than about 5 times the average particle size. The examples state the that particles are used in any of chemical-mechanic polishes discussed, which means the reference teaches the particles are dispersed in an aqueous medium. While the reference does not explicitly teach using a motorized polisher, the fact the articles being polished are semiconductor wafers and the type of polishing is chemical-mechanical polishing means the reference implicitly teaches using a motorized polisher. This is because chemical-mechanical polishing of semiconductor wafers are conventionally polished using a motorized chemical-mechanical polisher. The claimed composition and process read upon the taught compositions and process.

Applicants argue the patent to Rostoker is not enabling. Applicants have not presented any evidence the patent is not enabled. The fact the Siegel et al reference produces particles which have a particle size distribution broader that taught by Rostoker does not mean the reference is not enabling. Applicants have not presented any evidence methods of removing nanosized particles not in a desired particle size range were not well known to one of ordinary skill in the art at the time Rostoker was filed. Enablement does not require specific disclosure of what is already

known to one of ordinary skill in the art. *Case v. CPC International Inc.* 221 USPQ 196, 201 (Fed. Cir. 1984). A specification need not teach what is old or well known to those of ordinary skill in the art. *Case v. CPC International Inc.* 221 USPQ 196 (Fed. Cir. 1984); *In re Myers* 161 USPQ 668 (CCPA 1969); *In re Nelson* 126 USPQ 242 (CCPA 1960).

Applicants argue the statement the particles have a narrow (gaussian) distribution means that particles have a distribution that has a large tail corresponding to a small but significant number of particles with diameters considerably larger than average. Applicants have not presented any evidence to support this assertion. The conventional definition of gaussian distribution is the distribution curve has the shape of a normal probability curve, i.e., a bell curve. There is nothing in this definition which means the taught distribution has a large tail corresponding to a small but significant number of particles with diameters considerably larger than average. The definition means the taght distribution curve has the same shape as the distributions curves taught in the supplied article by Siegel et al and the supplied advertisement. The rejection is maintained.

Claims 1-6, 9-15, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandhu et al in view of Rostoker.

Sandhu et al teach a chemical-mechanical polish for semiconducting substrates comprising abrasive particles dispersed in either aqueous or non-aqueous solutions. The preferred particles are silica or alumina particles. Sandhu et al does not teach the particle size characteristics for the abrasive alumina or silica particles, which suggests to one of ordinary skill particles have any

particle size characteristics known to be used in chemical-mechanical polishes for semiconducting substrates. One of ordinary skill in the art would have found it obvious to use the particles of Rostoker as the abrasive alumina or silica particles in the dispersion of Sandhu et al. This is because Rostoker teaches the taught particles can be used in any chemical-mechanical polish for semiconducting substrates. Thus the references suggest the claimed composition and process.

Applicants' arguments with respect to this rejection is based on their arguments addressing the rejection over Rostoker. Since that argument is not convincing for the reasons cited above, the argument addressing this rejection is also not convincing. The rejection is maintained.

Claims 16, 25 and 26 are allowable over the cited art of record.

There is no teaching nor suggestion in the cited art of a polishing composition comprising an aqueous dispersion of metal carbide or metal sulfide particles, where the particles have an average particle size from about 5 to about 200 nm.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melissa Koslow whose telephone number is (703) 308-3817. The examiner can normally be reached on Monday-Thursday from 7:30 AM to 4:30 PM. The examiner can also be reached on alternate Fridays.

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The fax phone number for Amendments filed under 37 CFR 1.116 or After Final communications is (703) 305-3599. The fax number for all other official communications is (703) 305-5408.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661 or (703) 308-0662.

cmk
June 21, 1999

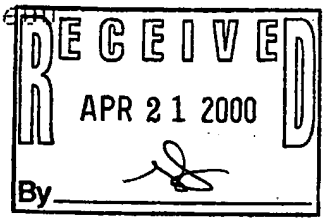
C. Melissa Koslow
Primary Examiner
Tech. Center 1700

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/961,735	10/31/97	KAMBE N	08510/015001

IM62/0418

PETER S. DARDI, PH.D
WASTMAN, CHAMPLIN & KELLY
INTERNATIONAL CENTRE, SUITE 400
900 SECOND AVENUE SOUTH
MINNEAPOLIS MN 55402-3319



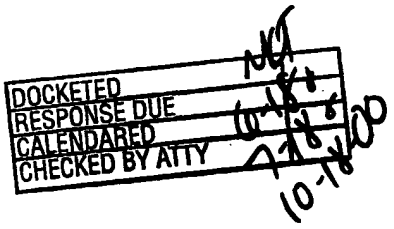
EXAMINER	
KOSLOW, C	

ART UNIT	PAPER NUMBER
1755	20

DATE MAILED: 04/18/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks



PTO-90C (Rev. 2/95)

2 - Mail Copy

Offic Action Summary	Application No. 08/961,735	Applicant(s) KAMBE ET AL.	
	Examin r C. Melissa Koslow	Art Unit 1755	

-- The MAILING DATE of this communication appears on th cov r sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

1)☒ Responsive to communication(s) filed on *31 March 2000* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16 and 23-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *16,25 and 26* is/are allowed.

6)☒ Claim(s) *1-15, 23 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a)☐ All b)☐ Some * c)☐ None of the CERTIFIED copies of the priority documents have been:

1.☐ received.

2.☐ received in Application No. (Series Code / Serial Number) _____ .

3.☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

14) ☐ Notice of References Cited (PTO-892)
15) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
16) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
17) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
18) ☐ Notice of Informal Patent Application (PTO-152)
19) ☐ Other:

This action is in response to applicants' response of 31 March 2000. Applicant's arguments have been fully considered but they are not persuasive.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 2 and 4-15, 23 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Rostoker.

This reference teaches a polishing composition comprising a dispersion of alumina or silica particles. The taught particles have an average diameter of 10-100 nm and a distribution where preferably 100% of the particles have a diameter within 50% of the average particle diameter, preferably 40% of the average diameter. This means the distribution of diameters such that 100% have a diameter greater than 40% of the average diameter and less than 140% of the average diameter. It is clear none of the taught particles have a diameter greater than about 5 times the average particle size. The examples state the particles are used in any of chemical-mechanic polishes discussed, which means the reference teaches the particles are dispersed in an aqueous medium. While the reference does not explicitly teach using a motorized polisher, the fact the articles being polished are semiconductor wafers and the type of polishing is chemical-mechanical polishing means the reference implicitly teaches using a motorized polisher. This is because chemical-mechanical polishing of semiconductor wafers is conventionally polished using a motorized chemical-mechanical polisher. The claimed composition and process read upon the taught compositions and process.

Applicants argue the patent to Rostoker is not enabling. Applicants have not presented any evidence the patent is not enabled and have provided a declaration Dr. Singh stating he is unaware of any processes which would allow one of ordinary skill in the art to produce the particle size distribution taught in Rostoker. Applicants are reminded every patent is presumed valid (35 U.S.C. 282), which means they are presumed enabled (*Metropolitan Eng. Co. v. Coe*, 78 F.2d 199, 25 USPQ 216 (D.C.Cir. 1935). Affidavits or declarations attacking the operability of a patent cited as a reference must rebut the presumption of operability by a preponderance of the evidence. *In re Sasse*, 629 F.2d 675, 207 USPQ 107 (CCPA 1980). See MPEP 716.07. The single supplied declaration does not represent a preponderance of evidence. With respect to the applicants' arguments that the only possible method meant by the statement on lines 30-36 in column 5 is that of '081, applicants are referred to column 1, lines 25-32 of '081 which states that there are "recently" developed methods to provide for controlled production of nanocrystals, which implies there must be other "recently" developed methods to provide for controlled production of nanocrystals known in the art besides that of '081. Applicants have not provided any evidence that the method of '081 was the only known method methods to provide for controlled production of nanocrystals known before 5 February 1993. The rejection is maintained.

Claims 1-6, 9-15, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandhu et al in view of Rostoker.

Sandhu et al teach a chemical-mechanical polish for semiconducting substrates comprising abrasive particles dispersed in either aqueous or non-aqueous solutions. The preferred particles are silica or alumina particles. Sandhu et al does not teach the particle size characteristics for the abrasive alumina or silica particles, which suggests to one of ordinary skill particles have any particle size characteristics known to be used in chemical-mechanical polishes for semiconducting substrates. One of ordinary skill in the art would have found it obvious to use the particles of Rostoker as the abrasive alumina or silica particles in the dispersion of Sandhu et al. This is because Rostoker teaches the taught particles can be used in any chemical-mechanical polish for semiconducting substrates. Thus, the references suggest the claimed composition and process.

Applicants' arguments with respect to this rejection is based on their arguments addressing the rejection over Rostoker. Since the above argument is not convincing for the reasons cited above, the argument addressing this rejection is also not convincing. The rejection is maintained.

Claims 16, 25 and 26 are allowable over the cited art of record for the reasons set forth in the previous office action.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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cmk
April 18, 2000

C. Melissa Koslow
Primary Examiner
Tech. Center 1700

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Kambe et al.	
Serial No.: 08/961,735	
Filed : October 31, 1997	Group Art Unit: 1755
For : ABRASIVE PARTICLES FOR SURFACE POLISHING	Examiner: C. Koslow
Docket No.: N19.12-0008	

DECLARATION UNDER 37 C.F.R. § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

I HEREBY CERTIFY THAT THIS PAPER IS BEING SENT BY U.S. MAIL, FIRST CLASS, TO THE ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231, THIS 23 DAY OF March, 2000.
Robert D. Paul
PATENT ATTORNEY

I, Rajiv K. Singh, Ph.D., hereby declare as follows:

1. I am presently a Professor of Material Science and Engineering at the University of Florida at Gainsville. Also, I am Associate Director of the Characterization, Research Instrumentation and Testbed Facility of the Engineering Research Center for Particle Science and Technology at the University of Florida. Apart from my academic responsibilities, I provide consulting services through R. K. Singh Consulting Inc.

2. I received my Ph.D. degree in 1989 in Material Science and Engineering from North Carolina State University, Raleigh, NC.

3. I have been on the faculty at the University of Florida since 1990. I was promoted to Associate Professor with tenure in 1995 and to full Professor in 1997. A copy of my Curriculum Vitae is attached.

4. My recent accomplishments include receiving a National Science Foundation Young Investigator Award in 1994 and the Hardy Gold Metal for Outstanding Contributions in Material Science in 1995. I was a Distinguished Visiting Professor/Scientist at National University of Singapore (1999) and National Institute for Materials and Chemical Research, Tsukuba, Japan (2000). I am the

author or co-author of more than 293 scientific articles and conference proceedings. I have co-edited five books and guest edited five journal issues.

5. I am under a Consulting Agreement with NanoGram Corporation to provide consulting services in the area of chemical-mechanical planarization. I am not a shareholder in NanoGram Corporation.

6. I have read carefully U.S. Patent 5,626,715 to Rostoker (the Rostoker patent) and the pending claims of the above noted patent application entitled "ABRASIVE PARTICLES FOR SURFACE POLISHING." I did not participate in any capacity with the preparation of the ABRASIVE PARTICLES FOR SURFACE POLISHING patent application.

7. I have been working in the area of surface polishing and material science relating to properties of inorganic particles for many years. Even though I have extensive knowledge of work relating to the processing and use of inorganic particles, I am unaware of any method suitable to separate a collection of nanoparticles to produce particles with a narrow size distribution as claimed in the present application, as of the October 31, 1997 filing date or the February 5, 1993 filing date of the Rostoker patent. In particular, I am very familiar with efforts to produce uniform particle sizes using filtration approaches. As of October 31, 1997 no filtration techniques were publicly available to produce inorganic nanoparticles with extremely narrow particle size distributions as disclosed and claimed in the ABRASIVE PARTICLES FOR SURFACE POLISHING application. To the best of my knowledge, there were no alternatives to filtration that could remove undesired particle sizes from nanoparticle collections.

8. Since no methods were publicly available to separate nanoparticles to produce collections of nanoparticles having the claimed narrow particle size distribution, the Rostoker patent does not enable a person of ordinary skill in the art to produce

abrasive particles with narrow particle size distribution indicated in the pending claims. Specifically, the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from about 5 nm to about 200 nm and a distribution of diameters such that at least about 95 percent of the particles have a diameter greater than about 60 percent of the average diameter and less than about 140 percent of the average diameter. Similarly, the Rostoker patent does not disclose to a person of skill in the art how to produce particles with an average diameter from 5 nm to 200 nm and effectively no particles with a diameter greater than about 5 times the average diameter.

11. I declare that all statements made herein that are of my own knowledge are true and that all statements that are made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: March 21 '2000 By: Rajiv K. Singh

Rajiv K. Singh, Ph.D.